4

MATHEMATICS 14



Module 4
MEASUREMENT

Learning Technologies Branch

Alberta LEARNING

MATHEMATICS 14

Module 4
MEASUREMENT

Mathematics 14
Module 4: Measurement
Student Module Booklet
Learning Technologies Branch
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The Learning Technologies Branch acknowledges with appreciation the Alberta Distance Learning Centre and Pembina Hills Regional Division No. 7 for their review of this Student Module Booklet.

This document is intended for	
Students	✓
Teachers	✓
Administrators	
Home Instructors	
General Public	
Other	

You may find the following Internet sites useful:

- Alberta Learning, **http://www.learning.gov.ab.ca**
- Learning Technologies Branch, **http://www.learning.gov.ab.ca/ltb**
- Learning Resources Centre, **http://www.lrc.learning.gov.ab.ca**

The use of the Internet is optional. Exploring the electronic information superhighway can be educational and entertaining. However, be aware that these computer networks are not censored. Students may unintentionally or purposely find articles on the Internet that may be offensive or inappropriate. As well, the sources of information are not always cited and the content may not be accurate. Therefore, students may wish to confirm facts with a second source.

Welcome to

MATHEMATICS 14

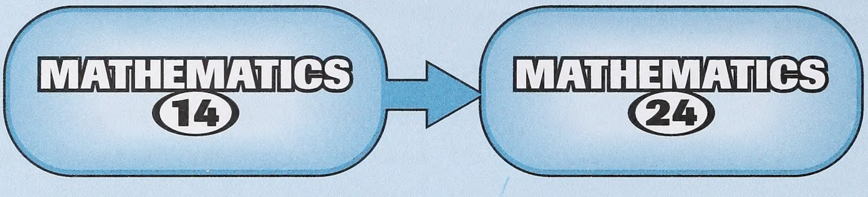
Mathematics 14 contains five modules. You should work through the modules in order (from 1 to 5) because concepts and skills introduced in one module will be reinforced, extended, and applied in later modules.

CONTENTS

COURSE FEATURES

The Mathematics 14–24 Program

Mathematics 14 is the first course in the Mathematics 14–24 sequence of courses. If you successfully complete each of these five-credit courses, you will meet the minimum requirements in mathematics for an Alberta high school diploma.



The Mathematics 14–24 sequence is designed for students whose needs, interests, and abilities focus on basic mathematical understanding. This course sequence emphasizes the acquisition of practical life skills and proficiency in using mathematics to solve problems, adapt to change, interpret information, and build on previous knowledge.

Consult your teacher or counsellor for the latest information. Also, if you have access to the Internet, you can find out more about Mathematics 14 and high school requirements at the Alberta Learning website.

http://www.learning.gov.ab.ca

Take the time to look through the Student Module Booklets and the Assignment Booklets and notice the following design features:

- Each module has a Module Overview, Module Summary, and Review.
- Each module has several sections. Each section focuses on a big idea that is central to the topic being learned in the module.
- Each section has several lessons.
- Each module has a Glossary and an Answer Key in the Appendix. In several modules there are also special pull-out pages in the Appendix.
- Each module references the CD that accompanies your *Continuum* textbook.

Required Resources

There are no spaces provided in the Student Module Booklets for your answers. This means you will need a binder and loose-leaf paper or a notebook to do your work.

In order to complete the course, you will need a copy of the Mathematics 14 textbook, *Continuum*, a scientific calculator (such as the Texas Instruments TI-30X IIS), and various manipulatives (pattern blocks and fraction blocks). For your convenience, cut-out fraction blocks are provided in the Appendix of Module 3.

Pattern blocks and fraction blocks are available from the Learning Resources Centre. As of 2003, the product codes for these items were 161901 and 408288, respectively. Check for the latest ordering information at the LRC website.

http://www.lrc.learning.gov.ab.ca

If you wish to complete the optional computer activities, you must have access to a computer that is connected to the Internet.

You will also need access to a computer to view material on the CD-ROM that accompanies your *Continuum* textbook.

Visual Cues

For your convenience, the most important mathematical rules and definitions are highlighted. Icons are also used as visual cues. Each icon tells you to do something.

Refer to the *Continuum* CD-ROM.

Use the Internet.

Refer to the textbook.

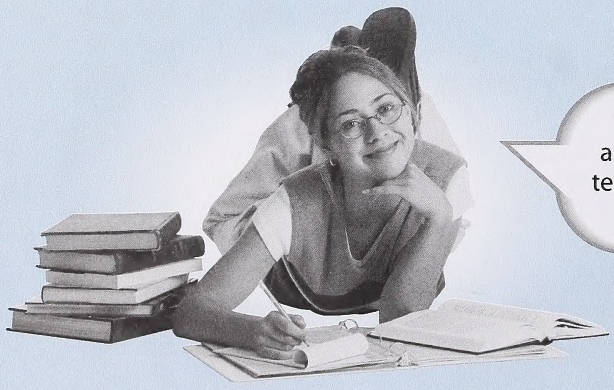
Use your calculator.

ASSESSMENT AND FEEDBACK

The Mathematics 14 course is carefully designed to give you many opportunities to discover how well you are doing. In every lesson you will be asked to turn to the Appendix to check your answers. Completing the lessons and comparing your answers to the suggested answers in the Appendix will help you better understand math concepts, develop math skills, and improve your ability to communicate mathematically and solve problems.

If you are having difficulty with a lesson, refer to the Answer Key in the Appendix for hints or help. As well as giving suggested answers to the questions, the Answer Key gives you more information about the questions.

Twice in each module you will be asked to give your teacher your completed assignments to mark. Your teacher will give you feedback on how you are doing.



After your teacher marks an assignment, be sure to review your teacher's comments and correct any errors you made.

There will be a Final Test at the end of the course. You can prepare for the Final Test by completing the Review at the end of each module.

MODULE OVERVIEW

Standards for business and commerce, manufacturing and construction, weights and measures, replacement parts, and consumer goods are the foundation of modern technological societies. For example, when a house is built, the plans the workers follow are based on standard sizes of lumber and sheeting, construction standards, and codes for plumbing and electrical work.

In Canada, measurement standards are the responsibility of the federal government. Since 1951, these standards have been maintained in Ottawa by the National Research Council's Institute for Measurement Standards. These standards are not just national—there are international agreements among other nations, such as Britain, the United States, France, Japan, Russia, and Germany.

In Section 1 you will explore systems of weights and measures. You will review the metric system and the imperial system of measurement. In Section 2 you will investigate a class of measurements called statistics.

Module 4
MEASUREMENT

Section 1
MEASUREMENT

Section 2
CENTRAL TENDENCIES

Your mark on this module will be determined by how well you complete the two Assignment Booklets.

The mark distribution is as follows:

Assignment Booklet 4A	
Section 1 Assignment	60 marks
Assignment Booklet 4B	
Section 2 Assignment	20 marks
Final Module Assignment	20 marks
Total	100 marks

When doing the assignments, work slowly and carefully. Be sure you attempt each part of the assignments. If you are having difficulty, you may use your course materials to help you, but you must do the assignments by yourself.

You will submit Assignment Booklet 4A to your teacher before you begin Section 2. You will submit Assignment Booklet 4B to your teacher at the end of this module.

SECTION 1

Measurement

This is just one of a number of measurement facts that your grandparents got to memorize as school children. These units belong to the British **imperial system** of weights and measures. However, these units were used a long time before Britain was a country! As a matter of fact, they had their origins in ancient Egypt over 4000 years ago, and variations of them were common throughout Europe and the Middle East.

The metric system arose in France as an effort to standardize and simplify measurements after the French Revolution. Today, the metric system is commonly used in the majority of countries around the world. In Canada, the metric system was legalized in 1871, although the imperial system continued to be widely used until the 1970s. Even today, many people still think of their height and weight in feet and inches and pounds and ounces rather than centimetres and kilograms. Do you?

In this section you will explore the metric and imperial systems of measure. You will investigate commonly used units of length, area, volume, and weight (or mass). You will use these units to solve a variety of everyday problems. You will use tables and technology to help you convert between metric and imperial units.

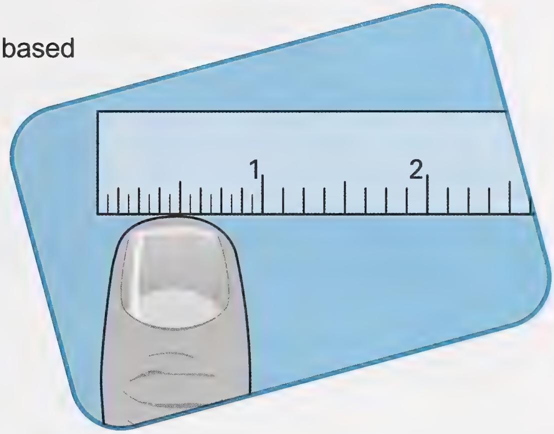
LESSON 1

Measuring Length in the Imperial System

Today you will explore how length is measured in the imperial system, the system of weights and measures that was used in Canada before the introduction of the metric system.

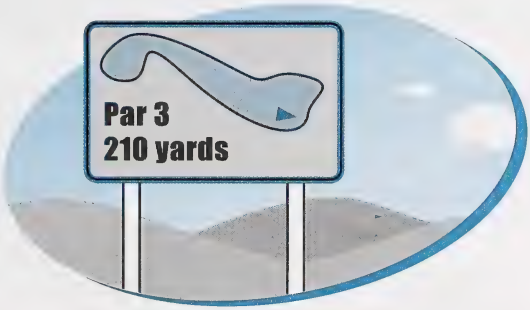
Have you ever helped frame a house or a basement? Many carpenters still work in **feet** and **inches**, in part because 4-foot by 8-foot exterior sheeting and interior drywall are still commonly used throughout North America. Feet and inches are two units of length in the imperial system.

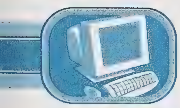
As the name suggests, the foot was based on the length of the king's foot. Measure the length of one of your shoes using an imperial ruler. Is it longer or shorter than 1 foot? There are 12 inches in a foot. An inch is close to the width of your thumb. In French, the word for thumb, *pouce*, is also the word for inch. So, you see, there are 12 "thumbs" in a "foot."



In the Middle Ages, people used three grains of barley, laid end to end, to obtain a more "exact" approximation for an inch. Grains of barley were used because of their uniform size.

A larger unit of length is the **yard**. There are 3 feet in 1 yard. The word *yard* comes from the word *gird*, a belt that was worn around the waist. Measure one of your belts. Is it 3 feet long? Not so long ago, merchants measured cloth in yards by pulling fabric past their noses. The distance from the tip of your nose to the tip of your outstretched arm is about 1 yard. If you were buying cloth, you would want to buy it from a tall merchant with long arms! Today, distances in Canadian football and on many golf courses are still measured in yards.



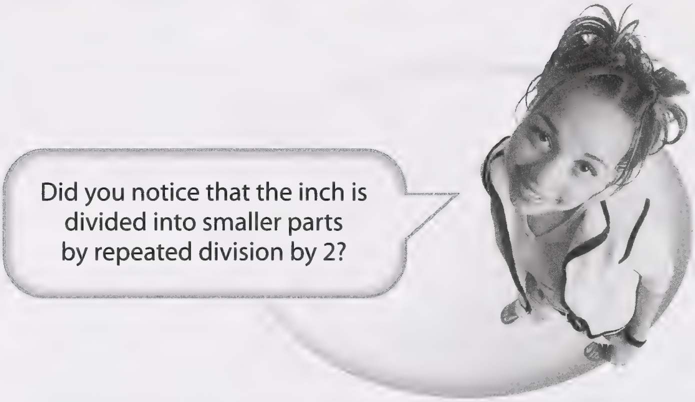


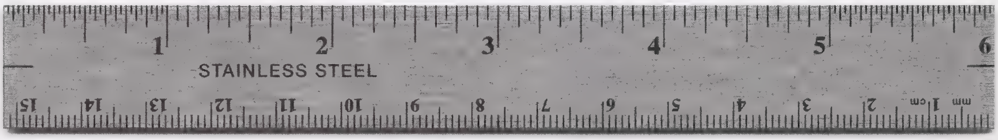
If you have access to the Internet, you can find out more about the origins of the imperial system at the following website:

http://www.ukmetrication.com/history2.htm

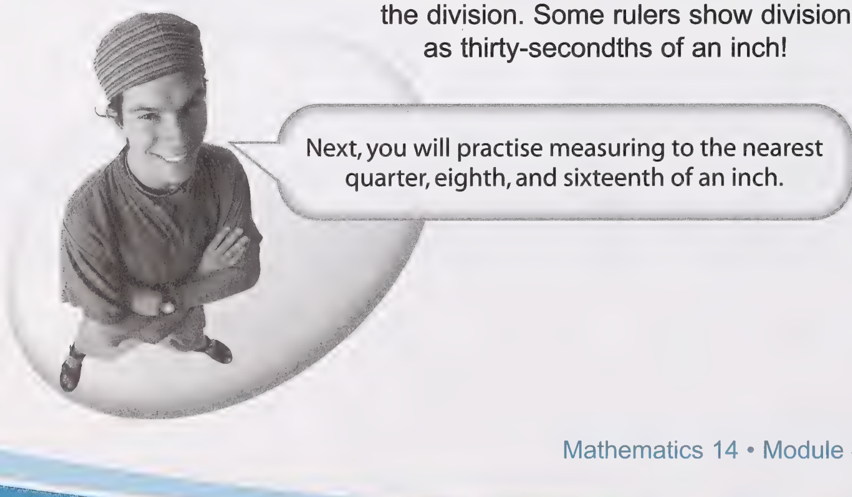
1. Take an imperial ruler, yardstick, carpenter's square, or tape measure and measure everyday items around you. For example, measure your height, the distance you cover when you take one long stride, the dimensions of your bedroom, the length of a car, the height of your living room, or the dimensions of a sheet of computer paper. Round your answers to the nearest inch.

Check your answers on page 69 in the Appendix.





The distance between the longest vertical lines on the ruler is 1 inch. The slightly shorter vertical lines mark the half-inch. There are 2 half-inches in 1 inch. The vertical lines next in length mark the quarter-inch. There are 4 quarter-inches in 1 inch. The lines next in length mark the eighth-inch. The shortest vertical lines mark the sixteenth-inch. As you can see, the shorter the vertical line, the smaller the division. Some rulers show divisions as small as thirty-secondths of an inch!



Turn to page 158 in your textbook. Read the examples highlighted in the blue box in "Investigation."

2. Turn to pages 158 and 159 in your textbook. Do questions 1 to 3.

3. Turn to page 160 in your textbook. Do questions 1 to 4 of "Put into Practice."

Check your answers on pages 69 and 70 in the Appendix.

Measurements in feet and inches are commonly abbreviated as follows.

6 feet and 2 inches = 6 ft 2 in or $6' \, 2''$

Example

Austin is $65\frac{1}{4}$ inches tall. How tall is Austin in feet and inches?

Remember, there are 12 inches in 1 foot. So, the number of feet in $65\frac{1}{4}$ inches is found by dividing by 12.

$$\begin{array}{r} 5 \\ 12\overline{)65\frac{1}{4}} \\ \underline{60} \\ 5\frac{1}{4} \end{array}$$

This shows that there are 5 feet plus $5\frac{1}{4}$ inches left over.

Austin is $5' \, 5\frac{1}{4}''$ tall.

Turn to page 161 in your textbook. Work through Example 1.

4. Turn to pages 161 and 162 in your textbook. Do questions 5, 6, 8, and 9 of "Put into Practice."

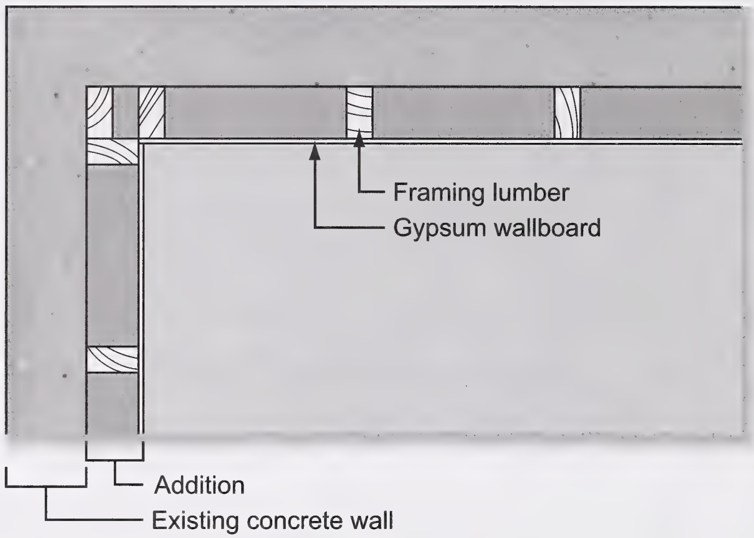
Check your answers on pages 70 and 71 in the Appendix.

Another important set of skills is adding and subtracting measurements in feet and inches.

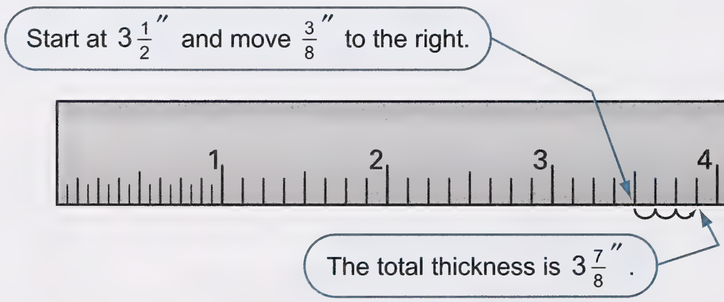
Example

John and his mother are finishing their basement. For the outside walls, they plan to use two-by-four framing lumber covered with $\frac{3}{8}''$ thick gypsum wallboard. How thick will this addition be?

Top View



A two-by-four is actually $1\frac{1}{2}''$ by $3\frac{1}{2}''$. The total thickness of the framing lumber and wallboard is $3\frac{1}{2}'' + \frac{3}{8}''$. Look at an imperial ruler or tape measure.



You can also do the calculation using pencil and paper!

$$
\begin{aligned}
3\frac{1}{2}'' + \frac{3}{8}'' &= 3\frac{4}{8}'' + \frac{3}{8}'' \\
&= 3\frac{7}{8}''
\end{aligned}
$$

Turn to page 163 in your textbook. Work through Example 1.

5. Turn to page 165 in your textbook. Do question 1 of "Put into Practice."

Check your answers on pages 71 and 72 in the Appendix.

Turn to page 164 in your textbook. Work through Example 2. Did you spot the error in the solution? Change $\frac{14}{6}$ to $\frac{16}{6}$. Change $\frac{35}{6}$ to $\frac{37}{6}$. The answer should be $6\frac{1}{6}'$ or $6'2''$.

There are a number of ways of solving this problem. Consider the following alternative.

Example

Do Example 2 from page 164 of the textbook by first adding the feet and inches separately.

Together, the space the bookcase and desk require is $2'8''+3'6''$.

$$\begin{aligned} 2'8''+3'6'' &= 5'14'' \\ &= 5'+1'2'' \text{ since } 14'' \text{ is } 2'' \text{ more than } 12'' \text{ or } 1'. \\ &= 6'2'' \\ &\text{or } 6\frac{2}{12}' \text{ or } 6\frac{1}{6}' \end{aligned}$$

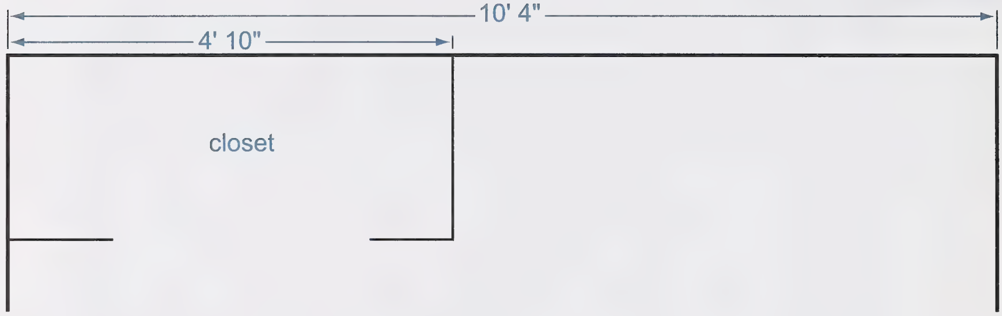
The bookcase and desk require $6'2''$.

Turn to page 165 in your textbook. Work through Example 3.

Once again, there are a number of ways of solving this problem. Consider the following alternative.

Example

Do Example 3 from page 165 of the textbook by first subtracting the feet and inches separately.



The space left on the wall is $10'4'' - 4'10''$. You cannot subtract $10''$ from $4''$, so you must regroup.

$$\begin{aligned} 10'4'' - 4'10'' &= (9' + 1'4'') - 4'10'' && \leftarrow 10' = 9' + 1' \\ &= 9'16'' - 4'10'' && \leftarrow 1' = 12'' \text{ and } 12'' + 4'' = 16'' \\ &= 5'6'' \\ &\text{or } 5\frac{6}{12}' \text{ or } 5\frac{1}{2}' \end{aligned}$$

Now it's time for you to practise your addition and subtraction skills.

6. Turn to page 166 in your textbook. Do questions 3 to 5 of "Put into Practice."

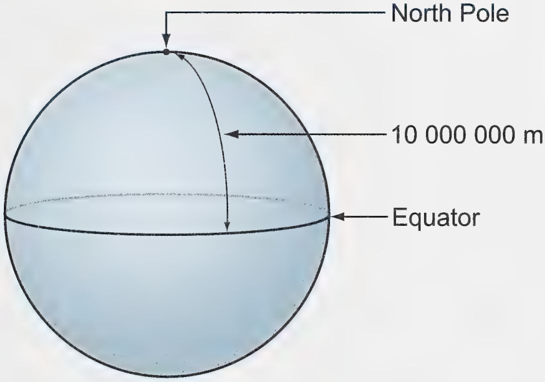
Check your answers on pages 72 and 73 in the Appendix.

Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer questions 1 and 2.

LESSON 2

Comparing Linear Measurements

Today you will review measuring lengths and distances in the metric system and you will compare metric and imperial **linear** measurements.



The base unit of length (or linear measurement) in the metric system is the metre. When the metric system was first developed in France over 200 years ago, the metre was defined as one ten-millionth of the distance from the North Pole to the equator. Today, because of the precision required in science and industry, the metre is defined as the distance travelled by light in a vacuum during a time interval of $\frac{1}{299\ 792\ 458}$ of a second.

If you have access to the Internet, you can find out more about the history of the metric system, often called SI (the international system of weights and measures), at the following website:

http://www.bipm.fr/enus/3_SI/si-history.html

Looking Back

In the metric system, prefixes are used to represent multiples or fractions of the base unit. The most common prefixes and symbols are shown in bold.

Prefix	Symbol	Factor
mega	M	1 000 000 or 10^6
kilo	**k**	1000 or 10^3
hecto	h	100 or 10^2
deca	da	10 or 10^1
deci	d	0.1 or 10^{-1}
centi	**c**	0.01 or 10^{-2}
milli	**m**	0.001 or 10^{-3}
micro	μ	0.000 001 or 10^{-6}

For length, the most common prefixes you will encounter are milli, centi, and kilo. You must be able to convert quickly between kilometres (km), metres (m), centimetres (cm), and millimetres (mm).

$1 \text{ km} = 1000 \text{ m}$ or $1 \text{ m} = 0.001 \text{ km}$
$1 \text{ m} = 100 \text{ cm}$ or $1 \text{ cm} = 0.01 \text{ m}$
$1 \text{ m} = 1000 \text{ mm}$ or $1 \text{ mm} = 0.001 \text{ m}$
$1 \text{ cm} = 10 \text{ mm}$ or $1 \text{ mm} = 0.1 \text{ cm}$

Because you are working with powers of ten, you simply move the decimal point to convert between units.

Example

Convert each of the following measures.

a. 3.2 km to metres
b. 45 mm to centimetres
c. 0.52 m to centimetres
d. 200 mm to metres

Solutions

a. Since $1 \text{ km} = 1000 \text{ m}$, multiply 3.2 km by 1000.

$$\begin{aligned} 3.2 \text{ km} &= 3.2 \times 1000 \text{ m} \\ &= 3200 \text{ m} \end{aligned}$$

Move the decimal 3 places to the right.

b. Since $1 \text{ mm} = 0.1 \text{ cm}$, multiply 45 mm by 0.1.

$$\begin{aligned} 45 \text{ mm} &= 45 \times 0.1 \text{ cm} \\ &= 4.5 \text{ cm} \end{aligned}$$

Move the decimal 1 place to the left.

c. Since $1 \text{ m} = 100 \text{ cm}$, multiply 0.52 m by 100.

$$\begin{aligned} 0.52 \text{ m} &= 0.52 \times 100 \text{ cm} \\ &= 52 \text{ cm} \end{aligned}$$

Move the decimal 2 places to the right.

d. Since $1 \text{ mm} = 0.001 \text{ m}$, multiply 200 m by 0.001.

$$\begin{aligned} 200 \text{ mm} &= 200 \times 0.001 \text{ m} \\ &= 0.2 \text{ m} \end{aligned}$$

Move the decimal 3 places to the left.

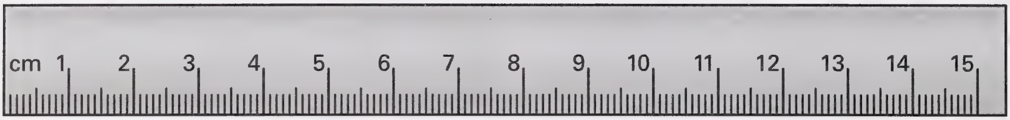
Check your skills!

1. Convert each of the following measures.

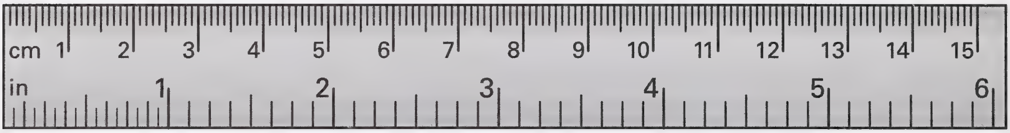
a. 3.2 m to centimetres
b. 45 mm to metres
c. 0.52 m to millimetres
d. 200 cm to metres
e. 3500 m to kilometres
f. 6.3 cm to millimetres

Check your answers on pages 73 and 74 in the Appendix.

If you look at a metric ruler or tape measure, the units usually shown are centimetres and millimetres.



A millimetre is about the thickness of a dime, and a centimetre is about the width of your little finger.



If you look at a ruler with both metric and imperial measures, an inch is a little over 2.5 cm. As a matter of fact, the inch is defined as exactly 2.54 cm.

In the next set of questions, you will investigate metric and imperial measures using the appropriate tools.

Turn to page 167 in your textbook. Work through Example 1.

2. Turn to pages 168 to 170 in your textbook. Do questions 1 to 6 of "Put into Practice."

Check your answers on pages 74 to 76 in the Appendix.

If you have ever travelled by car in the United States, you probably noticed that distances and speed limits are given in **miles** rather than kilometres. Drivers must be able to convert back and forth between miles and kilometres to plan their trips and to stay within the law. For example, a speed limit of 110 km/h in Canada is equivalent to about 70 mi/h in the United States. A mile is about 1.609 km or 1609 m.

Did you know that the origins of the mile can be traced back to ancient Rome? As a matter of fact, the English word *mile* is derived from *mille passus*, the Roman mile. *Mille passus* means "a thousand paces" in Latin. A Roman pace was actually two steps, about 5 ft in length. So, a Roman mile was 5000 ft. However, in the late sixteenth century, the government of England established the mile as 5280 ft so that there would be 8 furlongs in a mile—a furlong being 660 ft, the distance a horse could pull a plough before it needed a good rest!

Next, you will look at tables, your calculator, or your computer to help you covert between SI and imperial units.

Turn to page 171 in your textbook. The purple rectangle lists the factors by which you will multiply to convert linear measurements from one system to the other. Work through Example 1.

3. Turn to page 171 in your textbook. Do question 1 of "Put into Practice." Use your calculator to complete these calculations.

Check your answers on page 76 in the Appendix.

Your calculator may have built-in functions for metric conversions. Check your manual to see if your calculator has this feature and, if it does, how it is used.

If your calculator does not have this feature, there are many Internet sites that will perform these conversions for you. Try the following website:

http://www.convert-me.com/en/convert/length

4. Use the converter at the website given above to check your answers to question 3. If you can't access this particular website, use the search words *metric conversion* to search for another conversion website.

Check your answers on page 76 in the Appendix.

5. Turn to pages 171 and 172 in your textbook. Do questions 2 to 6 of "Put into Practice." Use the conversion table in your textbook, your calculator, or a metric converter on a website.

Check your answers on pages 77 and 78 in the Appendix.

Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer questions 3 to 7.

LESSON 3

Perimeter

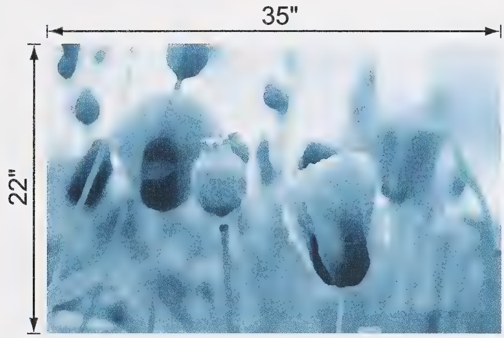
Today you will find the perimeter of a variety of figures using both metric and imperial measures.

Lynne works in an art studio. Part of her job is framing paintings. A rectangular painting she is working on measures 35 inches by 22 inches. What is the minimum length of framing material will she use?

Lynne's problem involves finding the **perimeter** of a rectangle. You will remember that the perimeter of a figure is the distance around the figure. If all the sides of the figure are staight line segments, the perimeter is simply the sum of the lengths of all the sides.

Example

What is the perimeter of the painting Lynne is framing?



Method 1: Adding the Lengths of the Sides

If you represent the base of the rectangle by the variable *b* and the height by *h*, you can use the following formula to calculate the perimeter, *P*.

$$\begin{aligned} P &= b + h + b + h \\ &= 35'' + 22'' + 35'' + 22'' \\ &= 114'' \end{aligned}$$

The perimeter is $114''$.

Method 2: Simplifying the Perimeter Formula

In a rectangle, there are two pairs of equal sides. You can simplify the formula for the perimeter.

$$\begin{aligned} P &= b + h + b + h \\ &= 2b + 2h \\ &= (2 \times 35'') + (2 \times 22'') \\ &= 70'' + 44'' \\ &= 114'' \end{aligned}$$

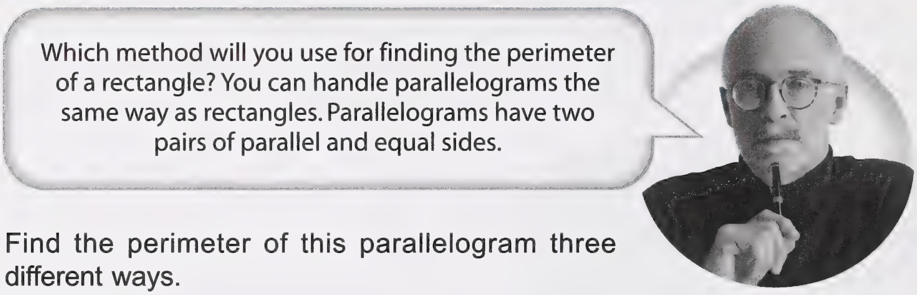
The perimeter is $114''$.

Method 3: Using the Semi-Perimeter

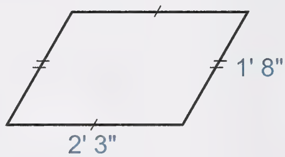
The perimeter is twice the sum of the two sides forming a right angle. Because the sum of $b+h$ is exactly half the perimeter of the rectangle, it is called the **semi-perimeter**.

$$\begin{aligned} P &= 2(b+h) \\ &= 2(35'' + 22'') \\ &= 2 \times 57'' \\ &= 114'' \end{aligned}$$

The perimeter is $114''$.



1. Find the perimeter of this parallelogram three different ways.



Turn to page 173 in your textbook. Work through Examples 1 and 2.

2. Turn to pages 174 and 175 in your textbook. Do questions 1 to 5 of "Put into Practice."

Check your answers on pages 78 to 80 in the Appendix.

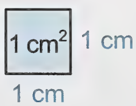
Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer question 8.

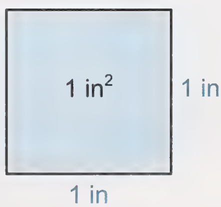
LESSON 4

Area

Today you will investigate the **areas** of rectangles, parallelograms, triangles, and regions that can be divided into two or more of these shapes. You will use the appropriate metric and imperial units in your investigation.

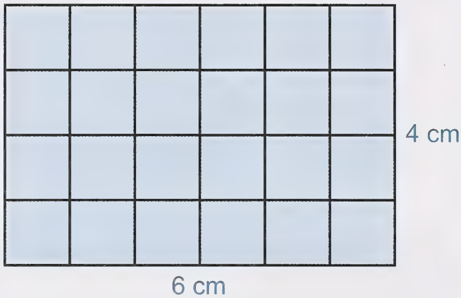
Jonathan Amisk has been hired by the band office to paint the interior of their building. The brand of paint Jonathan intends to use covers 10 m^2 per litre. The amount of paint he should buy to complete the job depends on the surface area to be covered. Area is measured in square units. Two common area units are the square centimetre $\left(cm^2\right)$ and the square inch $\left(in^2\right)$.





Example

What is the area of a rectangle that measures 6 cm by 4 cm?

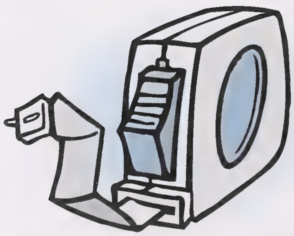


There are 4 rows. Each row contains $6\ \text{cm}^2$.

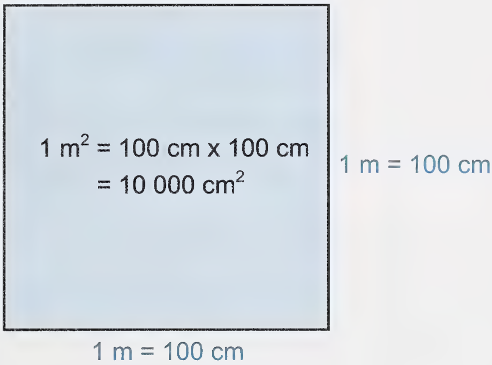
Therefore, area $= 4 \times 6\ \text{cm}^2 = 24\ \text{cm}^2$.

There are several common units for measuring area in both the metric and imperial systems.

SI		Imperial	
square centimetre	cm^2	square inch	in^2
square metre	m^2	square foot	ft^2
		square yard	yd^2
hectare	ha	acre	
square kilometre	km^2	square mile	mi^2



Often it is necessary to convert between units whether you are working with the metric system or the imperial system. Look at the metric units first.



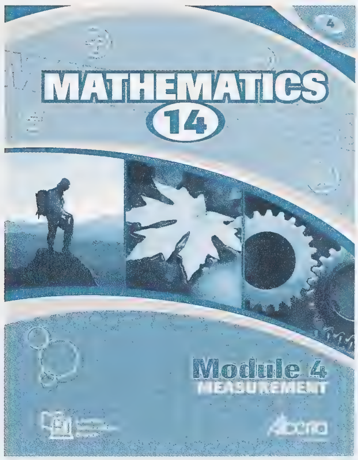
$1 \text{ m}^2 = 10\,000 \text{ cm}^2$ or $1 \text{ cm}^2 = 0.0001 \text{ m}^2$.

The area of smaller objects, such as the cover of your textbook, a ceramic tile, or the back of your hand, are measured in square centimetres.

The area of larger objects, such as a carpets, floors and walls, or lawns, are measured in square metres.

Example

The cover of this book is approximately 21.5 cm wide and 28 cm long. What is the area of this page? Express your answer in square centimetres and square metres.

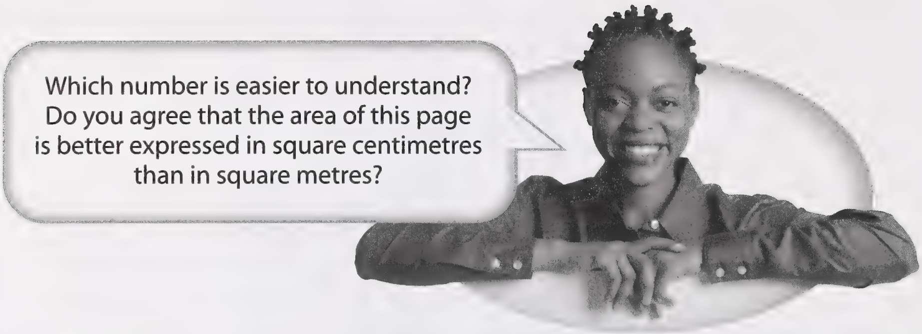


$$\begin{aligned} \text{area} &= \text{width} \times \text{length} \\ &= 21.5 \text{ cm} \times 28 \text{ cm} \\ &= 602 \text{ cm}^2 \end{aligned}$$

To convert the area into square metres, multiply by 0.0001.

$$\begin{aligned} \text{area} &= 602 \times 0.0001 \text{ m}^2 \\ &= 0.0602 \text{ m}^2 \end{aligned}$$

The area of this page is 602 cm^2 or 0.0602 m^2.



Now it's your turn.

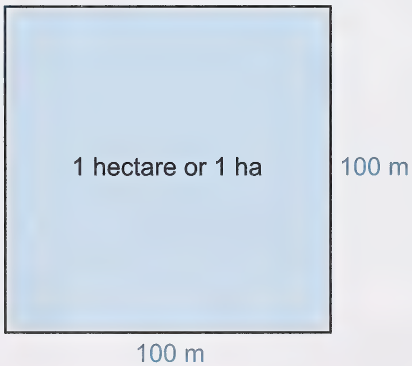
1. Convert each area.

a. $50\ 000\ \text{cm}^2$ to m^2 **b.** $8000\ \text{cm}^2$ to m^2

c. $0.05\ \text{m}^2$ to cm^2 **d.** $0.\ 0042\ \text{m}^2$ to cm^2

Check your answers on page 80 in the Appendix.

Hectares are used to describe the area of a farm or the size of a forest fire. A **hectare** (ha) is the area of a square that is 100 m by 100 m.



$$\begin{aligned} 10\ \text{ha} &= 100\ \text{m} \times 100\ \text{m} \\ &= 10\ 000\ \text{m}^2 \end{aligned}$$

For example, a soccer pitch is about 100 m by 50 m. Its area is 100 m $\times$ 50 m or 5000 m^2 or 0.5 ha.

2. Convert each of the following areas.

   a. 3.5 ha to m^2 b. 1 000 000 m^2 to ha

3. How many hectares are there in 1 km^2 ?

Check your answers on page 80 in the Appendix.

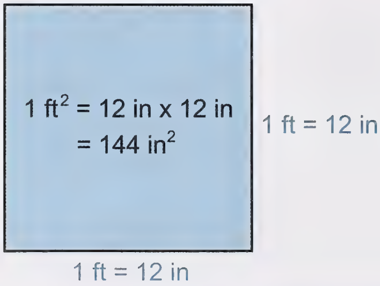
As you discovered in question 3, there are 100 ha in 1 km^2. Square kilometres are used for large areas. For example, the area of Great Bear Lake is approximately 31 300 km^2.

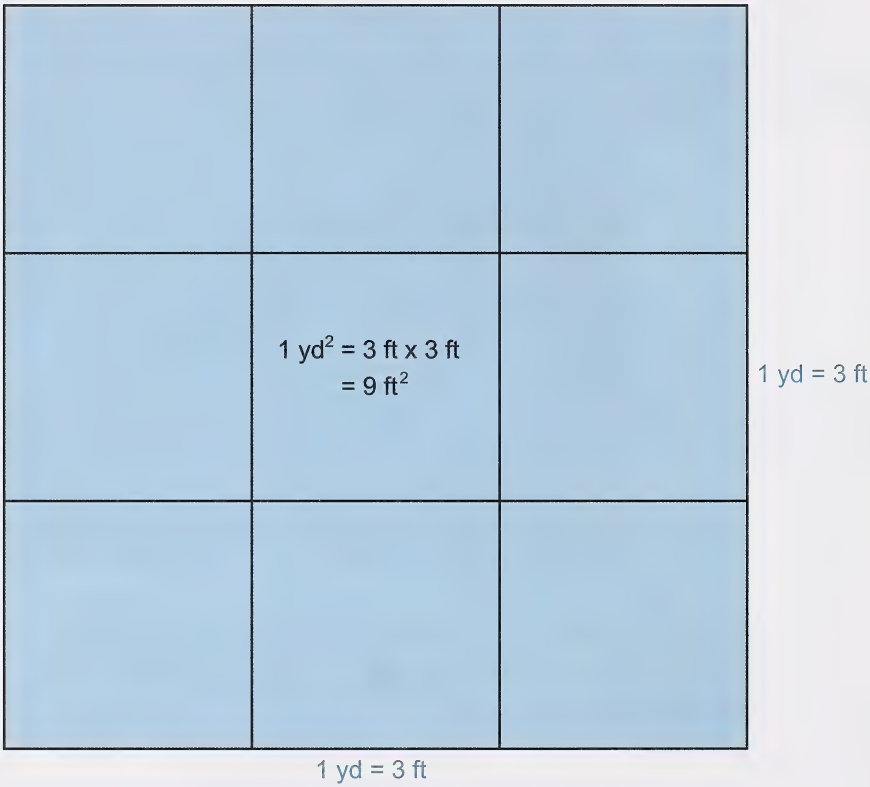
4. Use an atlas, an encyclopedia, or the Internet to research the areas of the following regions. Write your answers in square kilometres.

   a. your province or territory
   b. Canada
   c. Lake Superior
   d. Lake Baikal

Check your answers on pages 80 and 81 in the Appendix.

Next, you will look at the common conversions within the imperial system.





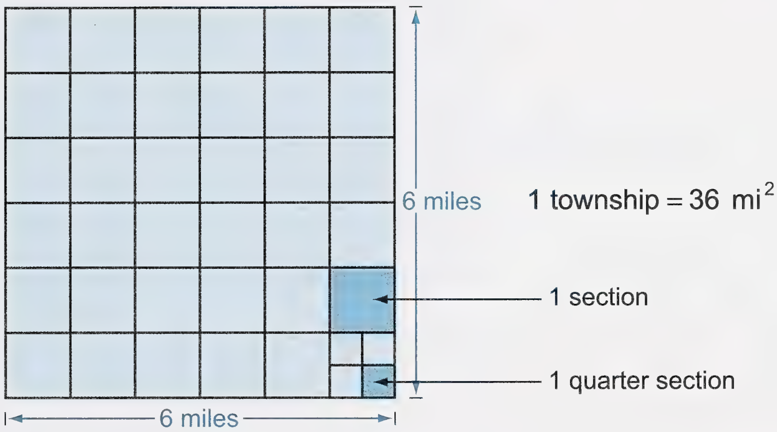
5. The page you are reading is 8.5 inches wide and 11 inches long. What is its area? Express your answer in square inches and square feet.

6. Which unit is more appropriate in question 5. Why?

7. Mercy's bedroom is 12 ft by 9 ft. What is her bedroom's area? If Mercy wants to carpet her bedroom, how many square yards of carpet are required?

Check your answers on page 81 in the Appendix.

In the last half of the nineteenth century, surveyors mapped Western Canada. The land was divided into squares that measured 6 miles on a side. These large squares were called **townships**.



A square mile was called a **section**, so there were 36 sections in a township. Each section was divided into quarters, or **quarter sections**. Each quarter section was one-half mile by one-half mile. These quarter sections were parcelled out as homesteads. Each quarter section was 160 acres in size. An **acre**, an imperial area measurement, is a square that measures approximately 70 yd on a side.

Today, you can see evidence of this survey from the air. North-south roads in the country are 1 mi apart. East-west roads are 2 mi apart. Seen from the air, the roads divide the countryside into rectangles measuring 1 mi by 2 mi in size. Each of these rectangles is two sections!

ALBERTA AGRICULTURE, FOOD AND RURAL DEVELOPMENT

8. How many acres are there in a section?

9. How many quarter sections are there in a township?

Check your answers on page 81 in the Appendix.

Occasionally, you will have to convert between the metric and imperial systems.

Area Conversion Factors	
$1\ \text{in}^2 = 6.4516\ \text{cm}^2$	$1\ \text{cm}^2 = 0.1550\ \text{in}^2$
$1\ \text{yd}^2 = 0.8361\ \text{m}^2$	$1\ \text{m}^2 = 1.1960\ \text{yd}^2$
$1\ \text{acre} = 0.4047\ \text{ha}$	$1\ \text{ha} = 2.471\ \text{acres}$
$1\ \text{mi}^2 = 2.5900\ \text{km}^2$	$1\ \text{km}^2 = 0.3861\ \text{mi}^2$

Use the previous table or a metric conversion site on the Internet to answer the following questions. If you are using the table, use your calculator to simplify your work!

10. Convert as required. Round your answers to 1 decimal place.

    a. 160 acres to ha **b.** $12\ \text{ft}^2$ to m^2

    c. $50\ \text{km}^2$ to mi^2 **d.** $1\ \text{ft}^2$ to cm^2

Check your answers on page 82 in the Appendix.

Now that you are familiar with the units for area, you will find the areas of a variety of geometric figures.

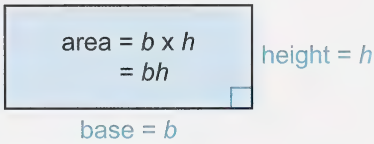
11. Turn to pages 176 and 177 in your textbook. Do questions 1 to 3 of "Investigation 1."

12. Turn to pages 177 and 178 in your textbook. Do questions 1 to 5 of "Put into Practice."

Check your answers on pages 82 to 84 in the Appendix.

As you saw in "Investigation 1," the formula for the area, A, of a rectangle is $A = bh$, where b is the base and h is the height.

This formula for the area of a rectangle can be used to derive a similar formula for the area of a parallelogram.

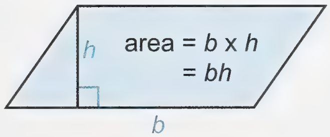


Turn to pages 179 and 181 in your textbook. Work through Examples 1 and 2.

13. Turn pages 180 to 182 in your textbook. Do questions 1 to 3 of "Put into Practice."

Check your answers on pages 85 and 86 in the Appendix.

In the previous questions, you used the formula for the area, A, of a parallelogram, $A = bh$, where b is the base and h is the height.



Next, you will investigate how the formula for the area of a triangle can be derived from the area of a parallelogram.

14. Turn to page 182 in your textbook. Do "Investigation."

15. Turn page 183 in your textbook. Work through Example 2. Do questions 4 to 6 of "Put into Practice."

Check your answers on pages 86 and 87 in the Appendix.

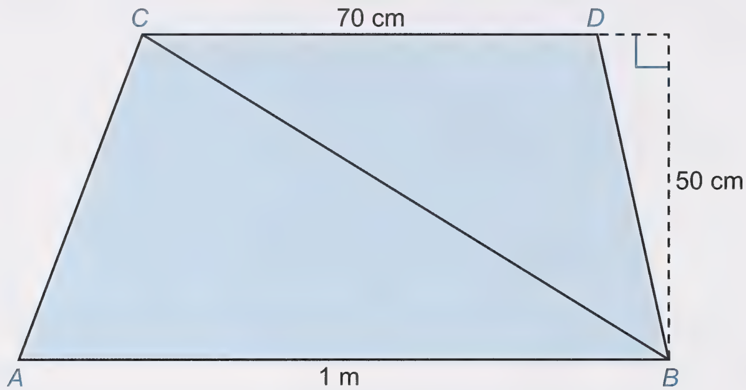
You have worked with the formulas for the areas of rectangles, parallelograms, and triangles. They are shown in the following table.

Figure	Base	Height	Area
Rectangle	b	h	bh
Parallelogram	b	h	bh
Triangle	b	h	$0.5\ bh$

You can use the formulas for area or combinations of these formulas to solve a variety of area problems. Make sure that when you apply these formulas, the units are the same for both the base and the height. For example, if the base is measured in centimetres and the height is in metres, you need to change them both to centimetres or both to metres.

Example

A trapezoid has dimensions as shown. What is the area of the trapezoid?



Segment BC divides the trapezoid into two triangles: ΔABC and ΔBCD.

$$\begin{aligned}\text{area of trapezoid } ABCD &= \text{area of } \Delta ABC + \text{area of } \Delta BCD \\ &= (0.5 \times 100 \text{ cm} \times 50 \text{ cm}) + (0.5 \times 70 \text{ cm} \times 50 \text{ cm}) \\ &= 2500 \text{ cm}^2 + 1750 \text{ cm}^2 \\ &= 4250 \text{ cm}^2\end{aligned}$$

The area of the trapezoid is 4250 cm^2.

16. Turn to pages 184 to 192 in your textbook. Do questions 7, 8, 9, 11, 12, 13, 15, 17, 18, and 20 of "Put into Practice."

Check your answers on pages 88 to 94 in the Appendix.

In this lesson you compared metric and imperial area units. You used these units and the formulas for the areas of rectangles, parallelograms, and triangles to solve a variety of problems.

To review the concepts in this lesson, work through “Lesson 10: Area of Polygons—Part 1” and “Lesson 11: Area of Polygons—Part 2” on the CD-ROM that accompanies your textbook.

Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer questions 9 and 10.

LESSON 5

Volume and Capacity

Today you will explore volume and capacity and the metric and imperial units by which they are measured.

Before underground sources of oil were tapped, oil came from the oceans. The whaling industry provided the oil for industry and homes. The whale oil was processed right on the whaling ships and stored in barrels until it reached port.

In the early days of underground oil exploration, crude oil was stored and sold in barrels. Even today, the price of crude oil is quoted in terms of barrels, although actual barrels are no longer used. But, what is a barrel? A barrel of oil is about 159 litres, or 35 imperial **gallons**, or 42 American gallons.

Gallons and litres are units of **capacity**—how much liquid or gas a vessel, such as a barrel, can hold. The capacity of an object is related to its **volume**. Volume is a measure of the three-dimensional size of an object. Some units of volume are the cubic metre $\left(m^3\right)$, cubic centimetre $\left(cm^3\right)$, cubic yard $\left(yd^3\right)$, and the cubic inch $\left(in^3\right)$.

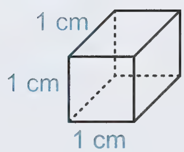
Looking Back

In previous mathematics courses, you explored metric units of capacity and volume.

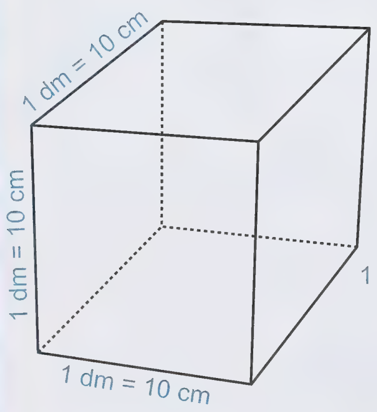
Examine the following table.

Capacity			Volume	
Unit	**Symbol**	**Meaning**	**Unit**	**Symbol**
kilolitre	kL	1000 L	cubic metre	m^3
litre	L	base unit	cubic decimetre	dm^3
millilitre	mL	0.001 L	cubic centimetre	cm^3

Units in the same rows are equivalent. For example, a cube that measures 1 cm on each side has a 1-mL capacity.



$1\ cm^3 = 1\ mL$



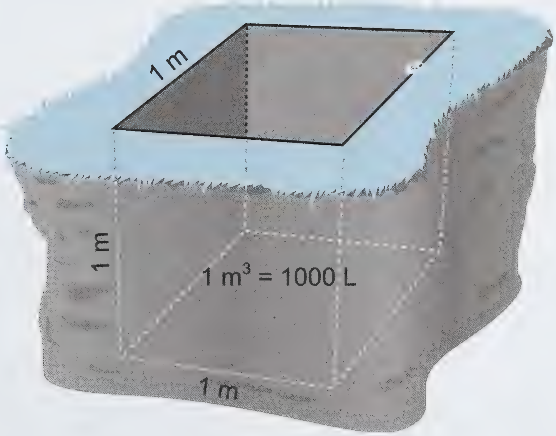
A cube that measures 1 dm or 10 cm on a side has a 1-L capacity. (**Note:** The diagram is not drawn to scale.)

$$
\begin{aligned}
1\ dm^3 &= 10\ cm \times 10\ cm \times 10\ cm \\
&= 1000\ cm^3 \\
&= 10\ 000\ mL \\
&= 1\ L
\end{aligned}
$$

Remember, $1\ \text{L} = 1000\ \text{mL}$ and $1\ \text{dm}^3 = 1000\ \text{cm}^3$. Think of a milk container. If it were shaped like a cube measuring 10 cm on each side, the container would hold 1 L of milk.

1. If you have a 1-L milk container in your refrigerator, measure its dimensions. Why do you think it is not a cube measuring 10 cm or 1 dm on each side?

Suppose you dug a hole in the ground that was the shape of a cube that measures 1 m on each side. It would take 1000 L of water to fill this hole.



2. Explain why $1\ \text{m}^3 = 1000\ \text{L}$.

You can convert easily between metric units of volume and capacity.

Example

Convert the units as indicated.

a. 500 mL to cm^3 **b.** 0.25 m^3 to L

Solutions

a. Because $1\ \text{mL} = 1\ \text{cm}^3$, $500\ \text{mL} = 500\ \text{cm}^3$.

b. Because $1\ \text{m}^3 = 1000\ \text{L}$, $0.25\ \text{m}^3 = 0.25 \times 1000\ \text{L}$

$$= 250\ \text{L}$$

Practise converting units by doing the following questions.

3. **a.** 125 mL to L and cm^3 **b.** 600 cm^3 to mL and L

   c. 60 L to mL and m^3 **d.** 250 dm^3 to L and kL

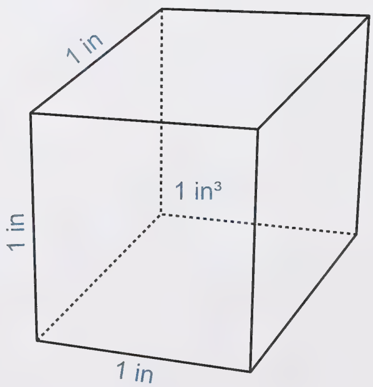
   e. 6000 kL to L and m^3 **f.** 6 m^3 to L and dm^3

Check your answers on pages 94 and 95 in the Appendix.

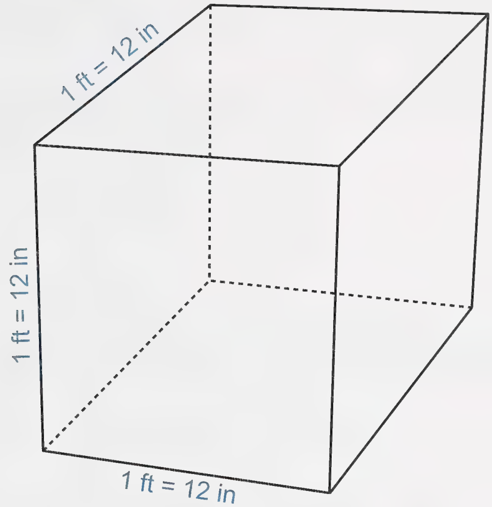
You are less likely to be familiar with imperial measures of volume and capacity.

Turn to page 193 in your textbook. Examine the imperial units of volume and capacity. These are the most common units you may encounter.

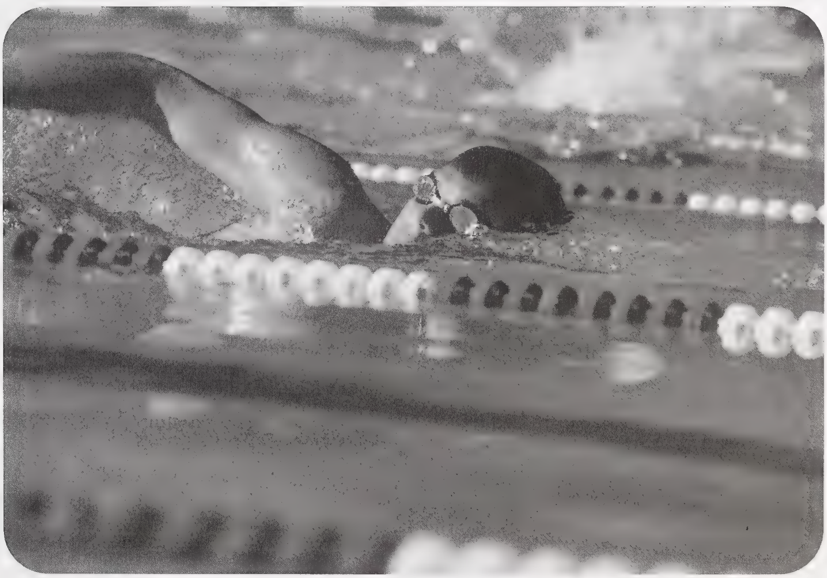
Car enthusiasts will know that the cubic inch $\left(in^3\right)$, together with the litre, provides a measure of vehicle engine displacement, called cubic inch displacement (or CID).



The cubic foot, $\left(\text{ft}^3\right)$, especially in the United States, is used to specify larger volumes, such as the volume of air in a room or the volume of a swimming pool.

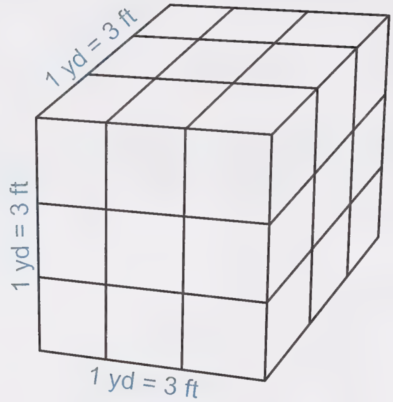


$$\begin{aligned}\text{Because } 1 \text{ ft} = 12 \text{ in, } 1 \text{ ft}^3 &= 12 \text{ in} \times 12 \text{ in} \times 12 \text{ in}\\ &= 1728 \text{ in}^3\end{aligned}$$



The cubic yard $\left(yd^3\right)$, corresponds to the cubic meter in the metric system. Like the cubic metre, the cubic yard is a large unit. 1 yd^3 is approximately 0.765 m^3.

Sand, gravel, garden dirt, and concrete are often sold by the cubic yard.



4. How many cubic feet are in a cubic yard? Explain your thinking.

Check your answer on page 95 in the Appendix.

The imperial units of capacity include the ounce, cup, pint, quart, gallon, and bushel. There are 2 cups in a pint, 2 pints in a quart, and 4 quarts in a gallon. A quart is slightly larger than a litre. An imperial quart is 1.14 L. However, to complicate matters, these measures are different in the United States than they are in Canada. The American quart and gallon are only $\frac{5}{6}$ as large as their Canadian equivalents. Inconsistencies like these are a good reason to use metric units to quote volumes and capacities.

A more comprehensive list of imperial and metric equivalents is on page 193 in your textbook. If you have done a little baking, you have probably encountered the cup and the liquid ounce in older recipes. There are 160 liquid ounces in an imperial gallon, or 40 liquid ounces in an imperial quart. You may see ounces on imported tinned goods.

5. Use the conversion factors on page 197 in your textbook and your calculator to perform the following conversions.

a. 2 quarts to L **b.** 15 yd^3 to m^3

c. 20 gallons to L **d.** 10 in^3 to cm^3

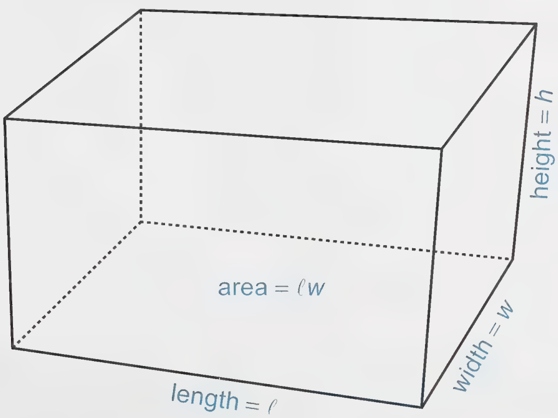
Check your answers on page 95 in the Appendix.

Next, you will use imperial and metric units to calculate volume.

6. Turn to page 194 in your textbook. Do questions 1 and 2 of "Investigation."

Check your answers on page 96 in the Appendix.

In "Investigation," you discovered that the volume, V, of a rectangular solid is the area, A, of its base multiplied by its height, h.



$$\text{volume} = \text{area of base} \times \text{height}$$
$$= A \times h$$

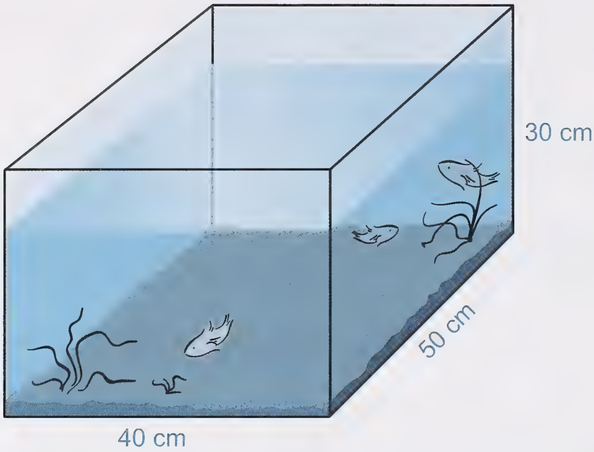
Because the base is a rectangle, $A = \ell \times w$.

Therefore, $V = A \times h$ or $V = \ell \times w \times h$.

You can use either formula to calculate the volume of a rectangular solid or box.

Example

The interior of a rectangular aquarium is 50 cm long, 40 cm wide, and 30 cm high. Determine its volume in cubic centimetres. Determine its capacity in millilitres and litres.



$$\begin{aligned} V &= \ell \times w \times h \\ &= 50 \text{ cm} \times 40 \text{ cm} \times 30 \text{ cm} \\ &= 60\ 000 \text{ cm}^3 \end{aligned}$$

The volume of the aquarium is $60\ 000 \text{ cm}^3$.

Because $1 \text{ cm}^3 = 1 \text{ mL}$, the capacity of the aquarium $= 60\ 000 \text{ mL}$

$= 60 \text{ L}$ $\quad 1 \text{ L} = 1000 \text{ mL}$

Turn to page 195 in your textbook. Work through the example.

7. Turn to pages 195 to 197 in your textbook. Do questions 1, 4, 5, 6, and 7 of "Put into Practice."

Check your answers on pages 96 to 98 in the Appendix.

In this lesson you compared metric and imperial units of volume and capacity. You used these units and the formulas for the volume of rectangular solids to solve a variety of problems.

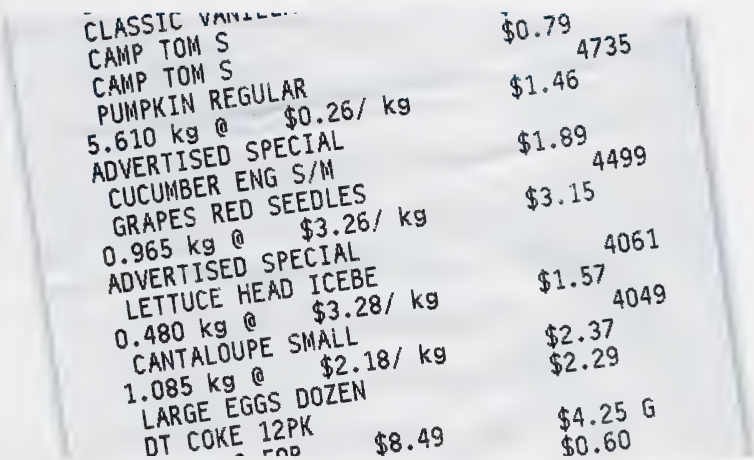
To review the concepts in this lesson, work through “Lesson 12: Volume and Capacity” on the CD-ROM that accompanies your textbook.

Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer question 11.

LESSON 6

Mass and Weight

Today you will explore weight and mass and the metric and imperial units used to measure them.



Many grocery stores advertise their fruits and vegetables by quoting both the price per pound and the equivalent price per kilogram. Often the price per pound is printed larger. One of the reasons for this is the price per pound is a little less than half the corresponding price per kilogram. Consumers may be more tempted to buy items if they see a lower price. However, when the items are weighed at the checkout, they are weighed in kilograms and the price on the receipt is given per kilogram.

Looking Back

The base unit of mass in the metric system is the gram. The most common units of mass are the milligram, gram, kilogram, and tonne.

Unit	Symbol	Size
tonne	t	1000 kg
kilogram	kg	1000 g
gram	g	base unit
milligram	mg	0.001 g

Originally the gram was defined as the mass of 1 mL of water at $4°C$. Because $1\ L = 1000\ mL$, the mass of 1 L of water is 1000 g or 1 kg. For example, 1 L of milk is approximately 1 kg. A 2-L bottle of soft drink is about 2 kg.

The mass of a raisin or a single peanut is about 1 g. One milligram is 0.001 g or 0.000 001 kg. Medication doses and the recommended daily intake of vitamins are often expressed in milligrams.

The tonne is a measure of large mass. Grain is sold by the **tonne**. The loads of tractor trailers are quoted in tonnes. A tonne is 1000 kg. Because 1 m^3 is 1000 L, and 1 L of water is 1 kg in mass, 1 tonne is the mass of 1 m^3 of water. If the average mass of a football player is 100 kg, then 10 football players would have a mass of about 1 tonne.

In common use, mass and weight are used interchangeably. In the sciences, the difference is important.

In the imperial system, weight is measured in pounds. A pound is approximately the weight of half a kilogram. To be more precise, a 0.454 kg mass has a weight of 1 lb. (Another way of looking at it is that a 1 kg mass has a weight of 2.205 lb.)

If you have a pound of butter in the refrigerator, take it out and hold it to get an idea of a 1-lb weight. Even today, people talk about their weight in pounds. Do you know how much you weigh in pounds and in kilograms?

A smaller unit than the pound is the **ounce**. Older recipes sometimes give the amount of flour, sugar, or butter in ounces (oz). There are 16 oz in 1 lb.

$$1 \text{ lb} = 16 \text{ oz}$$

Large weights, such as the weight of sand being hauled in a truck, is given in **tons**.

$$1 \text{ ton} = 2000 \text{ lb}$$

So, a metric tonne is roughly the same as an imperial ton. As a matter of fact, *ton* and *tonne* should be pronounced the same!

Turn to page 198 in your textbook. Use the conversion factors shown there to answer question 1.

1. **a.** Convert 150 lb to kilograms.
   b. Convert 50 g to ounces.
   c. Convert 16 oz to grams.
   d. Convert 1 tonne to tons.

Check your answers on page 98 in the Appendix.

Occasionally you will have to use your conversion skills to solve a variety of everyday problems.

Example

A farmer's market is selling 20 lb of potatoes for $8.00. What is the price per kilogram?

20 lb cost $8.00, so 1 lb costs $\$8.00 \div 20 = \$0.40$.
Because 1 kg $= 2.205$ lb, the price per kg is $\$0.40 \times 2.205$, or about $0.88.

The potatoes sell for $0.88/kg.

Example

A recipe for roast beef suggests a cooking time of 35 minutes per pound. What is the suggested cooking time per kilogram?

1 lb requires 35 min of cooking time.

1 kg weighs 2.205 lb, so 1 kg requires 35×2.205 min or about 77 min.

You can get a good estimate simply by doubling the time for 1 lb and then adding 0.1 more to your answer.

$$\text{estimate} = 2 \times 35 \text{ min} = 70 \text{ min}$$

$$0.1 \times 70 \text{ min} = 7 \text{ min}$$

$$70 \text{ min} + 7 \text{ min} = 77 \text{ min}$$

Try the following questions.

2. Turn to pages 198 to 200 in your textbook. Do questions 3 to 11 of "Put into Practice."

Check your answers on pages 98 to 100 in the Appendix.

Turn to the Section 1 Assignment in Assignment Booklet 4A. Answer questions 12 and 13.

When you are finished, submit Assignment Booklet 4A to your teacher to be marked.

CONCLUSION

In this section you explored the metric and imperial systems of measurements and the relationships between them. You used these systems in a variety of problem situations involving length, area, volume and capacity, and mass and weight. These problems included working with formulas for finding areas of rectangles, parallelograms, and triangles. You also applied the formulas for the volume of rectangular solids.

If you help with the grocery shopping, you will encounter both the metric and imperial systems of weights and measures. The prices of produce and meats are often given in both pounds and kilograms. Canned goods are measured in millilitres, but may include fluid ounce equivalents if they are imported from the United States. You may even see linear measures if there is a dry goods section. Eventually, imperial measures will be phased out, but until then consumers should have a working knowledge of both systems.

SECTION 2

Central Tendencies

Many people consider Wayne Gretzky one of the best hockey players of all time. During his twenty seasons in the NHL, he played in 1487 games. On average, in each regular season he scored 44.7 goals, had 98.15 assists, and earned 142.85 points.

Gretzky won the Hart Memorial Trophy for the most valuable player every year between 1980 and 1989, except for 1988. He received the Art Ross Trophy as the NHL scoring champion ten times, and he had the best plus-minus rating in the NHL during four seasons. He was a member of three Canada Cup winning teams and, during his time in Edmonton, won four Stanley Cups with the Edmonton Oilers.

Statistics are often cited in gauging the performance of professional athletes. Averages play an important role in these statistics. In this section you will explore different ways of reporting averages. You will see how these and other statistics are used in sports and in other situations.

LESSON 1

Mean, Median, and Mode

Today you will investigate measures of central tendency.

What does it mean to be of average height? Does it mean that more people are your height than any other height? Or, does it mean that half the population is shorter than you? Or, does it simply mean that the heights of everyone measured were added together and then this sum was divided by the number of people measured?

As you may already know, there are several different kinds of averages or **measures of central tendency**. An average, or measure of central tendency, is a single number that represents a set of numbers. The average most people are familiar with is the **mean**. The mean of a set of numbers is calculated by dividing the sum of all the numbers in the set by the number of numbers in the set.

Example

On Jason's hockey team, there are 6 players who play defence. Their weights are 69 kg, 58 kg, 55 kg, 64 kg, 72 kg, and 78 kg. What is the mean weight of these players?

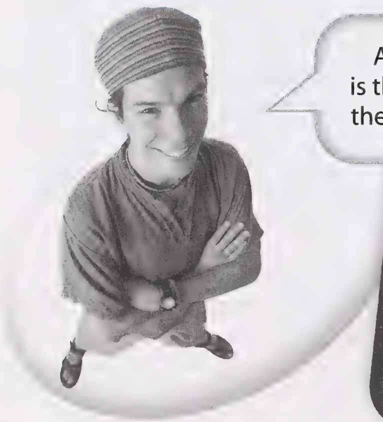
First, add the weights.

$$69 \text{ kg} + 58 \text{ kg} + 55 \text{ kg} + 64 \text{ kg} + 72 \text{ kg} + 78 \text{ kg} = 396 \text{ kg}$$

Next, divide by 6, the number of defencemen.

$$\begin{aligned} \text{mean} &= \frac{396 \text{ kg}}{6} \\ &= 66 \text{ kg} \end{aligned}$$

The mean weight of these players is 66 kg.



Another measure of central tendency or average is the **median**. Like the median of a divided highway, the median of a set of data splits it down the middle!

There are two methods needed for calculating a median. If there is an odd number of values, use the method from Example 1. If there is an even number of values, use the method in Example 2.

Example 1

In a basketball practice, 9 students took 10 free throws each at the basket. The following table gives the number of successful free throws per student.

Student	1	2	3	4	5	6	7	8	9
Successes	3	4	7	1	8	9	2	2	8

Determine the median number of successful free throws.

First, arrange the numbers of successful free throws in order from least to greatest.

1 2 2 3 4 6 7 8 9

There are 9 data values. Divide 9 by 2 and round your answer to the nearest whole number.

$$\frac{9}{2} = 4.5$$

Round 4.5 to 5.

Count 5 data values from either end of the arranged list. Circle the fifth number.

1 2 2 3 4 6 7 8 9

The median number of successful free throws is 4. Notice that there are the same number of values below the median as there are above the median.

Example 2

Reread the first example. Find the median weight of the six defencemen on Jason's hockey team.

First, arrange the players' weights in order from least to greatest.

55 kg   58 kg   64 kg   69 kg   72 kg   78 kg

There are 6 data values. Divide 6 by 2.

$$\frac{6}{2} = 3$$

Count 3 data values from each end of the arranged list.

55 kg   58 kg   64 kg   69 kg   72 kg   78 kg

The median is halfway between these two numbers.

So, find the mean of these two numbers.

$$\begin{aligned} \frac{64+69}{2} &= \frac{133}{2} \\ &= 66.5 \text{ kg} \end{aligned}$$

The median weight of the six defencemen on Jason's hockey team is 66.5 kg.

Notice that the median splits the data set into halves.

The third type of average is called the **mode**. The word *mode* in French means "fashion." Just as most people want to be in fashion, the mode of a data set is the most common value.

Example

Determine the modes of each data set.

a. 4, 5, 5, 5, 7, 7, 9
b. 4, 5, 5, 6, 6, 8
c. 1, 4, 6, 8, 9

Solutions

a. The number 5 occurs most often. The mode is 5.

b. Both 5 and 6 occur the same number of times and more often than any other value.

There are two modes, 5 and 6.

c. Each value occurs only once. This set has no mode!

Besides measures of central tendency, there is another measure used to describe a data set. The **range** of a set of numbers is the difference between the largest and smallest numbers.

Example

Return to the first example. What is the range of weights of the defencemen on Jason's team?

The heaviest player weighs 78 kg. The lightest player weighs 55 kg.

The range is $78\ \text{kg} - 55\ \text{kg} = 23\ \text{kg}$.

Turn to page 335 in your textbook. Study the word list in the green box. Then work through Example 1.

1. Turn to pages 336 to 338 in your textbook. Do questions 1, 2, 5, 6, and 7 of "Put into Practice."

2. Turn to page 339 in your textbook. Do questions a. to c. in “Investigation.”

3. Turn to pages 339 and 340 in your textbook. Do questions 2 to 4 of “Put into Practice.”

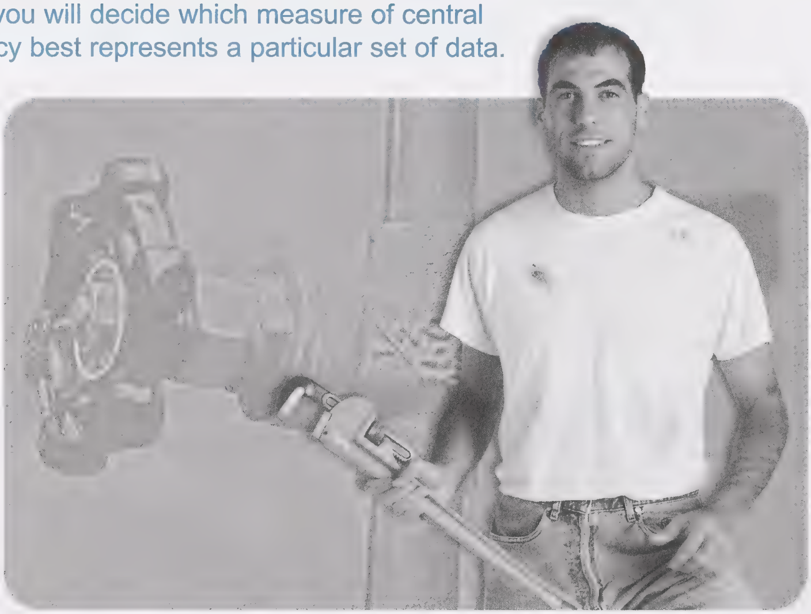
Check your answers on pages 100 to 107 in the Appendix.

Turn to the Section 2 Assignment in Assignment Booklet 4B. Answer question 1.

LESSON 2

Choosing the Mean, Median, or Mode

Today you will decide which measure of central tendency best represents a particular set of data.



Lesley owns a small residential plumbing business. Last year he withdrew \$95 000 from the business as personal income. He also employs three other plumbers. Their incomes last year were \$34 000, \$34 500, and \$28 500. What was Lesley’s and his employees’ “average” income?

Their mean income was $\dfrac{\$95\ 000+\$34\ 000+\$34\ 500+\$28\ 500}{4}$ or \$48 000.

How do the mean and median income compare?

Remember, to find the median income, first arrange the individual incomes in order from least to greatest.

\$28 500 \$34 000 \$34 500 \$95 000

The median will be halfway between \$34 000 and \$34 500.

Therefore, the median is $\dfrac{\$34\ 000+\$34\ 500}{2}$ or \$34 250.

Which measure do you think better represents the average income, \$34 250 or \$48 000? Why?

As you have just seen, the mean and median of a set of data can differ significantly if there are extreme values (either large or small) in the set.

Example

A class of nine physics students wrote a pop quiz. Their marks on this quiz, from lowest to highest, were 0%, 50%, 50%, 50%, 52%, 53%, 55%, 56%, and 57%.

a. Determine the mean, median, and mode.

b. Which of these measures best represents the performance of the students on this quiz? Explain your answer.

Solutions

a. $\text{mean} = \dfrac{0\% + 50\% + 50\% + 50\% + 52\% + 53\% + 55\% + 56\% + 57\%}{9}$

$= 47\%$

median $= 52\%$

mode $= 50\%$

b. Answers may vary. The mean, 47%, suggests that the students had a failing average. But, in fact, only one student failed the quiz. If you want to motivate the students to work harder, you may think the mean is the best average to tell them!

The median, 53%, splits the class in two. The same number of students had a mark lower than the median as had a mark higher than the median. If you wanted to give these students some indication about where they stand relative to the rest of the class, the median would be the best average. The students with marks of 53% or higher would know they are in the upper half of the class!

The mode is 50%. This is the best average if you want to emphasize that a student with a mark of 50% had company.

Example

Janice works in a men's clothing store. Her supervisor asked her to determine the average waist size of men's jeans that were sold that day so they could stock that size for their upcoming sale.

When Janice went through the sales slips, she recorded the sizes sold that day in the following table.

Waist Size	Number
24	3
27	1
32	20
36	1

First, Janice calculated the mean.

$$\text{mean} = \frac{(3\times24)+(1\times27)+(20\times32)+(1\times36)}{25}$$
$$= \frac{775}{25}$$
$$= 31$$

Do you think Janice should tell her supervisor to stock size 31 for the sale? After she calculated the mean, Janice realized nobody bought size 31. She knew the mean was not a good average in this situation. Because 20 out of the 25 sales were for size 32 jeans, she told her supervisor that the average size they sold was size 32. Do you agree that size 32, the mode, is the best average in this case?

1. Turn to page 341 in your textbook. Do questions a. and b. in “Investigation.”

2. Turn to page 342 in your textbook. Do questions 1.a. and 3 of “Put into Practice.”

3. Turn to pages 343 to 345 in your textbook. Do questions 1, 2, 6, 7, and 10 of “Put into Practice.”

4. Turn to pages 346 and 347 in your textbook. Do questions 1 and 2 of “Put into Practice.”

Check your answers on pages 107 to 110 in the Appendix.

In this lesson you compared the mean, median, and mode. You decided which of these measures best represented a particular situation. To review the concepts in this lesson, work through “Lesson 20: Central Tendencies” on the CD-ROM that accompanies your textbook.

Turn to the Section 2 Assignment in Assignment Booklet 4B. Answer questions 2 and 3.

LESSON 3

Plus/Minus Statistics

Today you will explore how plus/minus statistics are used.

Sara plays forward on her community league basketball team. The coach considers her one of his most valuable players and a team leader. Of all her teammates, Sara has the best plus/minus number. Since the beginning of this season, when she has been on the court, her team has earned 175 points. At the same time, only 132 points were scored against the team. Sara's plus/minus number is $175-132$ or 43.

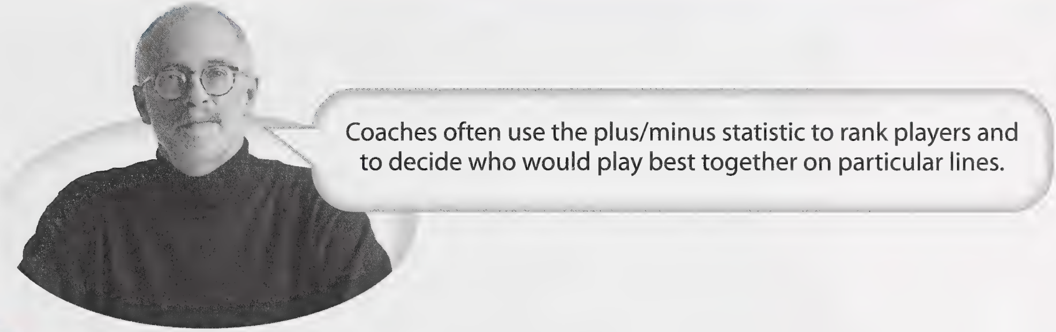
This year's performance is a significant improvement over last season. This year Sara has worked hard on both her offensive and defensive skills. Last year her plus\minus number was -10. Her team scored 10 fewer points than their opponents did when Sara was on the court.

You will practise finding and interpreting plus/minus statistics in the following questions.

Turn to page 348 in your textbook. Work through Example 1.

1. Turn to page 349 in your textbook. Do question 1 of “Put into Practice.”

Check your answers on pages 110 and 111 in the Appendix.



2. Turn to page 350 in your textbook. Do question 2 of “Put into Practice.”

Check your answers on pages 111 and 112 in the Appendix.

Turn to the Section 2 Assignment in Assignment Booklet 4B. Answer question 4.

CONCLUSION

In this section you explored the statistical measures of central tendency. You investigated the mean, median, mode, and range. You decided, based on the given situation, which measure best represented a set of values. Also, you considered the plus/minus statistic and its application in sports.

Do you participate in sports at your school or in your community? Do you help in keeping your team's statistics? Whether they are participants or spectators, most people are interested in performance records and team and player statistics. Look at the sports pages of a newspaper. Can you identify those statistics involving measures of central tendency and plus/minus numbers?

MODULE SUMMARY

In Section 1 you reviewed the metric system and explored the imperial system of weights and measures. You converted among units within each system and converted between systems. You applied your measurement skills in a variety of problem situations. These applications included finding perimeters of polygons; determining areas of rectangles, parallelograms, and triangles; and calculating volumes of rectangular prisms.

In Section 2 you extended your measurement skills to measures of central tendency and plus/minus numbers.

The French Revolution ushered in a new, efficient system of measurement that replaced an archaic and cumbersome one. The metric system was proposed to the French National Assembly in 1799, and today it is used almost everywhere in the world.

Turn to Assignment Booklet 4B and complete the Final Module Assignment.

When you are done, submit Assignment Booklet 4B to your teacher to be marked.

REVIEW

This Review will help you apply what you learned in Module 4 and prepare for the Final Test. Read over the skills checklist for this module. Use this list to guide your study and to help you decide how much of the Review you should complete.

Skills Checklist

Measurement

- ❑ Select and use appropriate measuring devices and measurement units for direct measurements (in imperial or metric units) to solve problems including
  – length/perimeter
  – area
  – volume/capacity
  – mass

- ❑ Estimate measurements of objects in metric and imperial systems including
  – length/perimeter
  – area
  – volume/capacity
  – mass

- ❑ Solve problems involving linear dimensions, area, and volume.

- ❑ Convert between metric and imperial systems of measure, using a conversion table or calculator.

- ❑ Develop a sense of approximate conversions between metric and imperial units through investigations.

- ❑ Use rules or expressions for determining the areas and perimeters of polygons by portioning them into rectangles and triangles.

Central Tendencies

- ❑ Determine measures of central tendency and variability for a set of data:
  - mode
  - median
  - mean
  - range

- ❑ Determine and use the most appropriate measure of central tendency in a given context.

If you need additional work to master the material in this module, work through the following lessons on the CD-ROM that accompanies your textbook:

- “Lesson 10: Area of Polygons—Part 1”
- “Lesson 11: Area of Polygons—Part 2”
- “Lesson 12: Volume and Capacity”
- “Lesson 20: Central Tendencies”

1. Turn to pages 203 to 207 in your textbook. Do questions 9 to 21 of “Review.”

2. Turn to pages 361 and 362 of your textbook. Do questions 2 to 7 of “Review.”

Check your answers on pages 112 to 119 in the Appendix.

MATHEMATICS

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Appendix

GLOSSARY
ANSWER KEY
IMAGE CREDITS

Glossary

acre: a unit of imperial measure that is approximately equal to the area of a square measuring 70 yd on a side

area: a measure of the number of square units on a surface

bushel: an imperial unit of capacity equal to 8 gallons

capacity: a measure of the amount a container can hold

cup: an imperial unit of capacity equal to one-half of a pint

foot: an imperial unit of linear measure equal to 12 in

gallon: an imperial unit of capacity equal to 4 quarts

gram: the metric base unit of mass

hectare: a metric unit of area measure equal to the area of a square measuring 100 m on a side

imperial system: a system of weights and measures using pounds and ounces, feet and inches, and gallons and quarts

inch: an imperial unit of linear measure defined as exactly 2.54 cm

linear measure: a measure of length

litre: the metric base unit of capacity

mean: the arithmetic average of a set of data

measures of central tendency: mean, median, and mode

median: the middle value in a set of ordered data

metre: the metric base unit of length

mile: an imperial unit of linear measure equal to 5280 ft

mode: the most frequently occurring value in a set of data

ounce (fluid): one-fortieth of a quart

ounce (weight): one-sixteenth of a pound

perimeter: the distance around something

pint: an imperial unit of capacity equal to one-half of a quart

plus/minus statistic: the difference between goals scored for and against

pound: an imperial unit of weight that is approximately equal to the weight of 454 g

quart: an imperial unit of capacity that is approximately equal to 1.137 L

quarter section: a square area measuring 0.5 mi on each side

range: the difference between the largest and smallest numbers in a set of data

section: a square area measuring 1 mi on each side

ton: an imperial unit of weight that is equal to 2000 lb

tonne: a metric unit of mass equal to 1000 kg

township: a square area measuring 6 mi on each side

volume: a measure of the number of cubic units displaced by an object

yard: an imperial unit of linear measure that is equal to 3 ft

Answer Key

Section 1: Measurement

Lesson 1: Measuring Length in the Imperial System

1. Answers will vary. Sample answers are given.

A long stride is approximately 3 feet or 1 yard.
The dimensions of many bedrooms are 9 feet by 12 feet.
The length of a car is about 15 feet.
The height of a living room is 8 feet.
A sheet of computer paper is $8\frac{1}{2}$ inches by 11 inches.

2. Textbook, pages 158 and 159, "Investigation," questions 1 to 3

1. Answers will vary. Sample answers are given.

a. A TI-30XIIS calculator is about $3\frac{1}{4}''$ wide at its widest part.
b. The width of your little finger is about $\frac{1}{2}''$.
c. The width of your thumb is approximately $1''$.
d. The width of two fingers together is about $1\frac{1}{4}''$.
e. The length of your little finger is about $2\frac{3}{4}''$.

2. Answers will vary. Sample answers are given.

a. $3\frac{1}{8}''$
b. $2\frac{5}{8}''$
c. $2\frac{1}{2}''$

d. Your results would likely be more precise because $\frac{1}{8}''$ is a smaller unit than $\frac{1}{4}''$.
e. Your partner's results will be different from yours.

3. Answers will vary. Sample answers are given.

a. $3\frac{3}{16}''$
b. $2\frac{9}{16}''$
c. $2\frac{7}{16}''$
d. Your results would likely be more precise because $\frac{1}{16}''$ is a smaller unit than $\frac{1}{8}''$.
e. Your partner's results will be different from yours.

3. Textbook, page 160, "Put into Practice," questions 1 to 4

Answers will vary. Sample answers are given.

1. a. The length of your foot is about $12''$.
b. The width of your fist is about $3''$.
c. Your handspan is about $8''$.

2. a. $10''$ b. $3''$ c. $7''$

3. The answers are reasonably close.

4. a. $1\frac{3}{8}''$ b. $2\frac{15}{16}''$ c. $1\frac{1}{4}''$ d. $3\frac{1}{16}''$ e. $\frac{1}{2}''$

4. Textbook, pages 161 and 162, "Put into Practice," question 5, 6, 8, and 9

5. a. $3' = 3 \times 12''$
$= 36''$

b. $1'8'' = 12'' + 8''$
$= 20''$

c. $2\frac{1}{4}' = (2 \times 12'') + \left(\frac{1}{\cancel{4}_1} \times \cancel{12}^{3}{}''\right)$
$= 24'' + 3''$
$= 27''$

6. **a.** $60'' = 60 \text{ in} \div 12 \text{ in/ft}$
$= 5 \text{ ft}$

b. $80'' = 72'' + 8''$
$= (6 \times 12'') + 8''$
$= 6'8''$

$$\begin{array}{r} 6 \\ 12\overline{)80} \\ \underline{72} \\ 8 \end{array}$$

c. $52'' = 48'' + 4''$
$= (4 \times 12'') + 4''$
$= 4'4''$

$$\begin{array}{r} 4 \\ 12\overline{)52} \\ \underline{48} \\ 4 \end{array}$$

8. Answers will depend on your situation. Work with a partner to confirm your measurements.

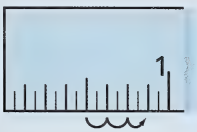
9. Answers will vary. Sample answers are given.

Many businesses still use imperial measures. Some examples are hardware stores, lumberyards, carpet stores, grocery stores, and plumbing businesses.

Many businesses use metric measures. Some examples are grocery stores, power companies, water and gas utilities, gasoline retailers, and garages.

5. Textbook, page 165, "Put into Practice," question 1

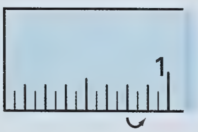
1. **a.**



Start at $\frac{1}{2}''$ and move $\frac{3}{8}''$ to the right.

$$\frac{3}{8} + \frac{1}{2} = \frac{1}{2} + \frac{3}{8}$$
$$= \frac{7}{8}$$

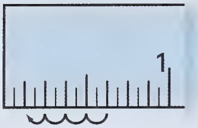
b.



Start at $\frac{3}{4}''$ and move $\frac{1}{8}''$ to the right.

$$\frac{3}{4} + \frac{1}{8} = \frac{7}{8}$$

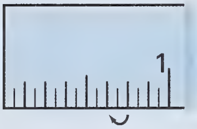
c.



Start at $\frac{5}{8}''$ and move $\frac{1}{2}''$ (or $\frac{4}{8}''$) to the left.

$$\frac{5}{8}-\frac{1}{2}=\frac{1}{8}$$

d.



Start at $\frac{3}{4}''$ and move $\frac{1}{8}''$ to the left.

$$\frac{3}{4}-\frac{1}{8}=\frac{5}{8}$$

6. Textbook, page 166, "Put into Practice," questions 3 to 5

3. length of bookcase + length of table + length of desk $= 2'6'' + 3'4'' + 2'9''$

$$\begin{aligned} &= 7'19'' \\ &= 7' + (12'' + 7'') \\ &= 7' + 1'7'' \\ &= 8'7'' \end{aligned}$$

Yes, Estelle can place them side-by-side on a wall measuring $9'6''$.

4. length of wall – length of closet $= 10'4'' - 5'10''$

$$\begin{aligned} &= (9' + 1'4'') - 5'10'' \\ &= (9' + 12'' + 4'') - 5'10'' \\ &= 9'16'' - 5'10'' \\ &= 4'6'' \end{aligned}$$

There is $4'6''$ of wall space beside the closet.

5. distance Jen trained $= 2\frac{1}{4}\text{ mi} + 1\frac{1}{3}\text{ mi} + 1\frac{1}{2}\text{ mi}$

$$= \frac{9}{4}\text{ mi} + \frac{4}{3}\text{ mi} + \frac{3}{2}\text{ mi}$$
$$= \frac{9\times3}{4\times3}\text{ mi} + \frac{4\times4}{3\times4}\text{ mi} + \frac{3\times6}{2\times6}\text{ mi}$$
$$= \frac{27}{12}\text{ mi} + \frac{16}{12}\text{ mi} + \frac{18}{12}\text{ mi}$$
$$= \frac{61}{12}\text{ mi}$$
$$= 5\frac{1}{12}\text{ mi}$$

distance Derek trained $= 1\frac{2}{3}\text{ mi} + 1\frac{1}{4}\text{ mi} + 1\frac{1}{2}\text{ mi}$

$$= \frac{5}{3}\text{ mi} + \frac{5}{4}\text{ mi} + \frac{3}{2}\text{ mi}$$
$$= \frac{5\times4}{3\times4}\text{ mi} + \frac{5\times3}{4\times3}\text{ mi} + \frac{3\times6}{2\times6}\text{ mi}$$
$$= \frac{20}{12}\text{ mi} + \frac{15}{12}\text{ mi} + \frac{18}{12}\text{ mi}$$
$$= \frac{53}{12}\text{ mi}$$
$$= 4\frac{5}{12}\text{ mi}$$

Jen covered the greater distance in training.

$$5\frac{1}{12}\text{ mi} - 4\frac{5}{12}\text{ mi} = \frac{61}{12}\text{ mi} - \frac{53}{12}\text{ mi}$$
$$= \frac{8}{12}\text{ mi}$$
$$= \frac{2}{3}\text{ mi}$$

Jen trained $\frac{2}{3}$ mi farther than Derek.

Lesson 2: Comparing Linear Measurements

1. a. $3.2\text{ m} = 3.2 \times 100\text{ cm}$

$= 320\text{ cm}$ Move the decimal 2 places to the right.

b. $45 \text{ mm} = 45 \times 0.001 \text{ m}$
$= 0.045 \text{ m}$ Move the decimal 3 places to the left.

c. $0.52 \text{ m} = 0.52 \times 1000 \text{ mm}$
$= 520 \text{ mm}$ Move the decimal 3 places to the right.

d. $200 \text{ cm} = 200 \times 0.01 \text{ m}$
$= 2 \text{ m}$ Move the decimal 2 places to the left.

e. $3500 \text{ m} = 3500 \times 0.001 \text{ km}$
$= 3.5 \text{ km}$ Move the decimal 3 places to the left.

f. $6.3 \text{ cm} = 6.3 \times 10 \text{ mm}$
$= 63 \text{ mm}$ Move the decimal 1 place to the right.

2. Textbook, pages 168 to 170, "Put into Practice," questions 1 to 6

1. Answers will vary. Sample answers are given.

Item	Measurement Tool Used	Measure in SI Units	Measure in Imperial Units
a. Width of your small finger	tape or ruler	1 cm	$\frac{3}{8}''$
b. Width of two fingers	tape or ruler	3.8 cm	$1\frac{1}{2}''$
c. Length of your foot	tape or ruler	25 cm	$10''$
d. Length of your large stride	tape or ruler	90 cm	$3'$
e. Length of your regular stride	tape or ruler	70 cm	$2\frac{1}{4}'$
f. Length of a standard paperclip	tape or ruler	3.2 cm	$1\frac{1}{4}''$
g. Thickness of a dime	tape or ruler	1 mm	$\frac{1}{32}''$

2. a. Answers will vary. Sample answers are given.

- 1 cm: the width of your fingernail on your small finger
- 1 m: a large stride
- 1 yd: the distance from your nose to your fingertips
- 1 mm: the thickness of a dime
- 1 in: the width of your thumb

b. How did your benchmarks compare with the suggested answers in question 2.a.?

3. Answers in the table will depend on your personal circumstances.

4. Fifty pieces of paper are approximately 5 mm thick. Therefore, 1 piece of paper is $5 \text{ mm} \div 50$ or 0.1 mm thick.

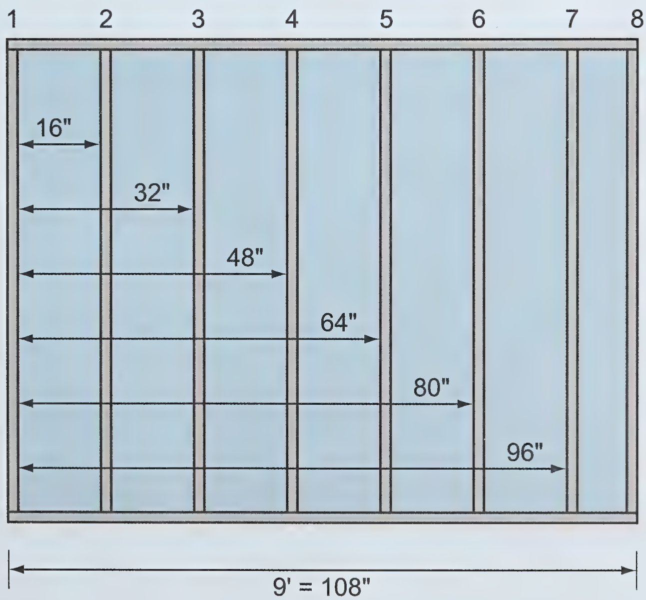
5. a. The length of the wall is $9'$.

$$\begin{aligned} 9' &= 9 \times 12'' \\ &= 108'' \end{aligned}$$

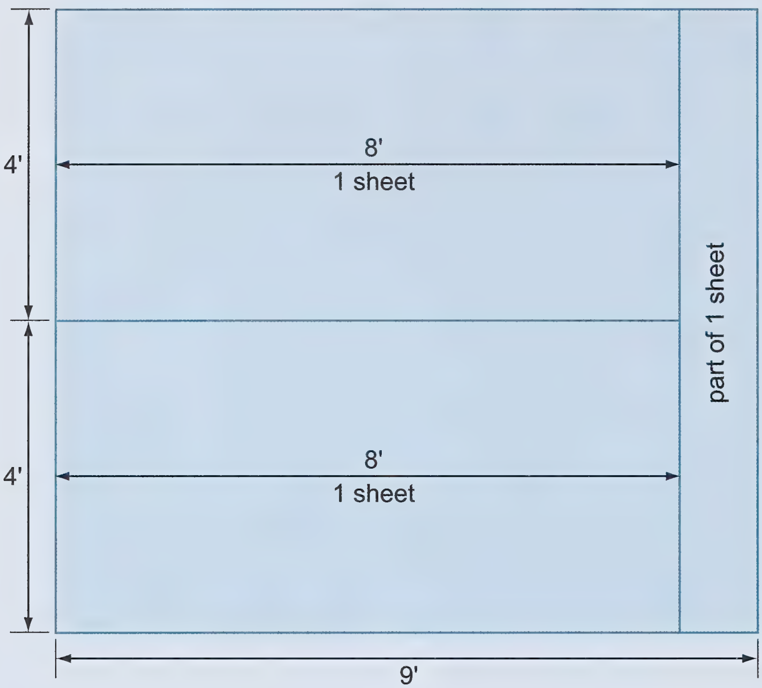
Studs are spaced every $16''$.

$$108'' \div 16'' = 6.75$$

Six studs are needed along the wall plus the two studs in the corners. Therefore, eight studs are needed to frame the wall.



b. Two sheets of drywall are required from the floor to the ceiling if they are positioned horizontally. The sheets are 8″ long. Therefore, a third sheet is required at the end of the 9′ wall.



6. a. 3″ or about 8 cm (7.6 cm)

b. 13″ or about 23 cm (22.9 cm)

c. 4′2″ or about 127 cm (126.9 cm)

3. Textbook, page 171, "Put into Practice," question 1

1. a. $1\text{ km} = 0.621\text{ mi}$, so $153\text{ km} \doteq 95.0\text{ mi}$

b. $1\text{ m} = 3.281\text{ ft}$, so $23.5\text{ m} \doteq 77.1\text{ ft}$

c. $1\text{ yd} = 0.914\text{ m}$, so $7\text{ yd} \doteq 6.4\text{ m}$

d. $1\text{ ft} = 0.305\text{ m}$, so $214\text{ ft} \doteq 65.3\text{ m}$

e. $1\text{ m} = 1.094\text{ yd}$, so $127\text{ m} \doteq 138.9\text{ yd}$

f. $1\text{ km} = 0.621\text{ mi}$, so $318\text{ km} \doteq 197.5\text{ mi}$

4. Your answers should be the same!

5. Textbook, pages 171 and 172, "Put into Practice," questions 2 to 6

2. $$\begin{aligned}100\ \text{km/h} &= 100 \times 0.621\ \text{mi/h}\\ &= 62.1\ \text{mi/h}\end{aligned}$$

You are driving at about the speed limit of 60 mi/h.

3. $$\begin{aligned}\text{Edmonton to Fairbanks} &= \text{Edmonton to Dawson Creek} + \text{Dawson Creek to Fairbanks}\\ &= 586\ \text{km} + 1568\ \text{mi}\\ &= 586\ \text{km} + (1568 \times 1.609\ \text{km})\\ &\doteq 586\ \text{km} + 2523\ \text{km}\\ &\doteq 3109\ \text{km}\end{aligned}$$

To the nearest kilometre, it is 3109 km from Edmonton to Fairbanks.

4. $$\begin{aligned}65\ \text{ft} &= 65 \times 0.305\ \text{m}\\ &= 19.825\ \text{m}\\ &\doteq 20\ \text{m}\end{aligned}$$

$$\begin{aligned}150\ \text{ft} &= 150 \times 0.305\ \text{m}\\ &= 45.75\ \text{m}\\ &\doteq 46\ \text{m}\end{aligned}$$

The dimensions of the plot are approximately 20 m by 46 m.

5. $$\begin{aligned}\text{length of a CFL field} &= 110\ \text{yd}\\ &= 110 \times 0.914\ \text{m}\\ &= 100.54\ \text{m}\end{aligned}$$

This is $100.54\ \text{cm} - 100\ \text{m}$ or 0.54 m longer than a soccer pitch.

6. a. $$\begin{aligned}190.8\ \text{m} &= 190.8 \times 1.094\ \text{yd}\\ &= 208.7352\ \text{yd}\\ &\doteq 208.7\ \text{yd}\end{aligned}$$

The Calgary Tower is about 208.7 yd high.

b. $190.8 \text{ m} = 190.8 \times 3.281 \text{ ft}$
$= 626.0148 \text{ ft}$
$\doteq 626 \text{ ft}$

The Calgary Tower is about 626 ft high.

$190.8 \text{ m} = 626.0148 \text{ ft}$
$= 626.0148 \times 12 \text{ in}$
$= 7512.1776 \text{ in}$
$\doteq 7512 \text{ in}$

The Calgary Tower is about 7512 inches high.

c. Each step is about $7512 \div 802 \doteq 9.4$ inches high.

Lesson 3: Perimeter

1.

$$\begin{aligned} P &= (2'3'' + 1'8'') + (2'3'' + 1'8'') \\ &= 6'22'' \\ &= 6' + (12'' + 10'') \\ &= 6' + 1'10'' \\ &= 7'10'' \end{aligned}$$

or

$$\begin{aligned} P &= 2(2'3'' + 1'8'') \\ &= 2(3'11'') \\ &= 6'22'' \\ &= 6' + (12'' + 10'') \\ &= 6' + 1'10'' \\ &= 7'10'' \end{aligned}$$

2. Textbook, pages 174 and 175, "Put into Practice," questions 1 to 5

1. a. $P = 4 \times 6 \text{ cm}$
$= 24 \text{ cm}$

b. $P = 2(9 \text{ cm} + 15 \text{ cm})$
$= 2(24 \text{ cm})$
$= 48 \text{ cm}$

c. $P = 4 \times 8 \text{ cm}$
$= 32 \text{ cm}$

d. $P = 18 \text{ cm} + 8.5 \text{ cm} + 12 \text{ cm} + 8 \text{ cm}$
$= 46.5 \text{ cm}$

e. $P=\left(2\times 5\tfrac{1}{4}''\right)+\left(4\times 7\tfrac{1}{2}''\right)$

$=\left(\cancel{2}^{1}\times \dfrac{21''}{\cancel{4}_{2}}\right)+\left(4\times \dfrac{15''}{2}\right)$

$=\dfrac{21''}{2}+\dfrac{60''}{2}$

$=\dfrac{81''}{2}$

$=40\tfrac{1}{2}''$

2. For a square or rhombus, $P=4s$, where s is the length of each side.

For a parallelogram, $P=2(a+b)$, where a and b are the lengths of adjacent sides.

3. $5'9''=(5\times 12'')+9''$

$=60''+9''$

$=69''$

The counter length is $69''$. Divide this length by $4\tfrac{1}{2}''$.

$69''\div 4.5''=15.33$

Therefore, Khadija needs 16 tiles.

4. a. $P=2(1.25\text{ m}+1.9\text{ m})$

$=2(3.15\text{ m})$

$=6.30\text{ m}$

$=6.30\times 3.281\text{ ft}$

$=20.6703\text{ ft}$

$\doteq 20.7\text{ ft}$

$1.25\text{ m}=1.25\times 3.281\text{ ft}$

$=4.101\,25\text{ ft}$

$1.9\text{ m}=1.9\times 3.281\text{ ft}$

$=6.2339\text{ ft}$

The perimeter is about 20.7 ft.

b. Mr. Kassam needs four 8-ft lengths or will need a joint that is not at the corner. (Two pieces cannot be cut from one 8-foot length.)

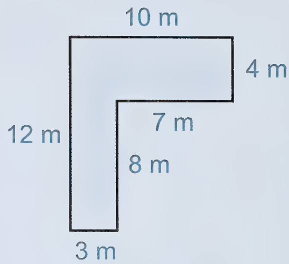
c. Mr. Kassam needs only two 12-ft lengths. Since $6.2339 + 4.101\,25$ is less than 12, he can cut a length and a width from each 12-ft piece.

5. $P = 10\text{ m} + 4\text{ m} + 7\text{ m} + 8\text{ m} + 3\text{ m} + 12\text{ m}$

$= 44\text{ m}$

$= 44 \times 3.281\text{ ft}$

$= 144.364\text{ ft}$



If moulding is sold by the foot, Jose should purchase 145 ft.

Lesson 4: Area

1. a. $50\,000\text{ cm}^2 = 50\,000 \times 0.0001\text{ m}^2$

$= 5\text{ m}^2$

b. $8000\text{ cm}^2 = 8000 \times 0.0001\text{ m}^2$

$= 0.8\text{ m}^2$

c. $0.05\text{ m}^2 = 0.05 \times 10\,000\text{ cm}^2$

$= 500\text{ cm}^2$

d. $0.0042\text{ m}^2 = 0.0042 \times 10\,000\text{ cm}^2$

$= 42\text{ cm}^2$

2. a. $3.5\text{ ha} = 3.5 \times 10\,000\text{ m}^2$

$= 35\,000\text{ m}^2$

b. $1\,000\,000\text{ m}^2 = 1\,000\,000 \times 0.0001\text{ ha}$

$= 100\text{ ha}$

3. $1\text{ km}^2 = 1\text{ km} \times 1\text{ km}$

$= 1000\text{ m} \times 1000\text{ m}$

$= 1\,000\,000\text{ m}^2$

$= 1\,000\,000 \times 0.0001\text{ ha}$

$= 100\text{ ha}$

There are 100 ha in 1 km^2.

4. a. Answers may vary slightly. Sample answers are given.

Alberta: $661\,848\text{ km}^2$
British Columbia: $944\,735\text{ km}^2$
Manitoba: $647\,797\text{ km}^2$
Northwest Territories: $1\,346\,106\text{ km}^2$
Nunavut: $2\,093\,190\text{ km}^2$
Saskatchewan: $651\,036\text{ km}^2$

b. Canada: $9\,984\,670\text{ km}^2$

c. Lake Superior: $82\,100\text{ km}^2$

d. Lake Baikal: $31\,500\text{ km}^2$

5. $$\begin{aligned} A &= b \times h \\ &= 8.5\text{ in} \times 11\text{ in} \\ &= 93.5\text{ in}^2 \end{aligned}$$

$$\begin{aligned} 93.5\text{ in}^2 &= 93.5\text{ in}^2 \div 144\text{ in}^2/\text{ft}^2 \\ &\doteq 0.65\text{ ft}^2 \end{aligned}$$

The area of this page is about 93.5 in^2 or 0.65 ft^2.

6. The more appropriate unit in question 5 is square inches because the dimensions were given in inches. Also, 93.5 in^2 may be easier to visualize than 0.65 ft^2.

7. $$\begin{aligned} \text{area} &= b \times h \\ &= 9\text{ ft} \times 12\text{ ft} \\ &= 108\text{ ft}^2 \end{aligned}$$

The area of Mercy's bedroom is 108 ft^2.

$$\begin{aligned} 108\text{ ft}^2 &= 108\text{ ft}^2 \div 9\text{ ft}^2/\text{yd}^2 \\ &= 12\text{ yd}^2 \end{aligned}$$

Mercy needs 12 yd^2 of carpet for her bedroom.

8. 1 quarter section $= 160$ acres

$$\begin{aligned} 1\text{ section} &= 4 \times 160\text{ acres} \\ &= 640\text{ acres} \end{aligned}$$

9. $$\begin{aligned} 1\text{ township} &= 36\text{ sections} \\ &= 36 \times 4\text{ quarter sections} \\ &= 144\text{ quarter sections} \end{aligned}$$

10. a. $160 \text{ acres} = 160 \times 0.4047 \text{ ha}$
$= 64.752$
$\doteq 64.8 \text{ ha}$

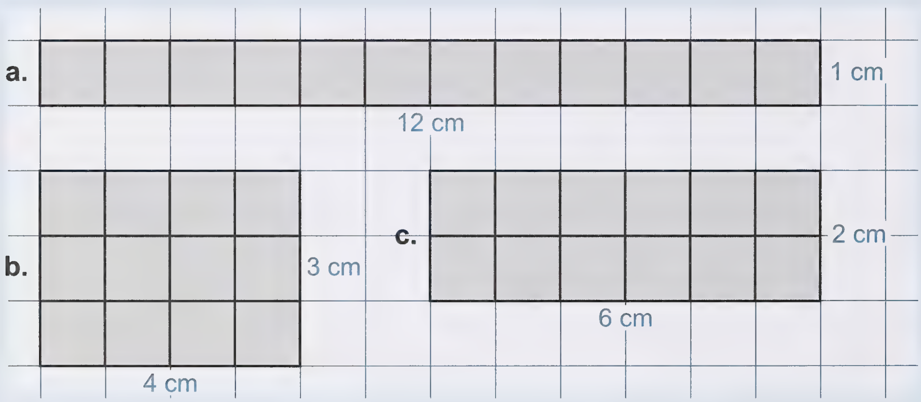
b. $12 \text{ ft}^2 = \frac{12}{9} \text{ yd}^2$
$= \frac{4}{3} \text{ yd}^2$
$= \frac{4}{3} \times 0.8361 \text{ m}^2$
$= \frac{4 \times 0.8361}{3} \text{ m}^2$
$= 1.1148 \text{ m}^2$
$\doteq 1.1 \text{ m}^2$

c. $50 \text{ km}^2 = 50 \times 0.3861 \text{ mi}^2$
$= 19.305 \text{ mi}^2$
$\doteq 19.3 \text{ mi}^2$

d. $1 \text{ ft}^2 = 144 \text{ in}^2$
$= 144 \times 6.4516 \text{ cm}^2$
$= 929.0304 \text{ cm}^2$
$\doteq 929.0 \text{ cm}^2$

11. Textbook, pages 176 and 177, Investigation, questions 1 to 3

1.



2. a. 42 cm^2

b. $(18+6) \text{ cm}^2 = 24 \text{ cm}^2$ or $(30-6) \text{ cm}^2 = 24 \text{ cm}^2$

c. 16 cm^2

d. 15 cm^2

3. A shorter way is to realize there are $\boxed{6}$ rows of $\boxed{7}$ squares so that the number of squares is $\boxed{7} \times \boxed{6} = \boxed{42}$.

To determine the area of a **rectangle**, **multiply** the base by the $\boxed{\text{height}}$.

$A = \boxed{\text{base}} \times \boxed{\text{height}}$

12. Textbook, pages 177 and 178, "Put into Practice," questions 1 to 5

1. a. $$\begin{aligned} A &= bh \\ &= 12 \text{ cm} \times 1 \text{ cm} \\ &= 12 \text{ cm}^2 \end{aligned}$$

b. $$\begin{aligned} A &= bh \\ &= 4 \text{ cm} \times 3 \text{ cm} \\ &= 12 \text{ cm}^2 \end{aligned}$$

c. $$\begin{aligned} A &= bh \\ &= 6 \text{ cm} \times 2 \text{ cm} \\ &= 12 \text{ cm}^2 \end{aligned}$$

2. a. $$\begin{aligned} A &= bh \\ &\doteq 21.5 \text{ cm} \times 24 \text{ cm} \\ &\doteq 516 \text{ cm}^2 \end{aligned}$$

The area of the front cover of your textbook is about 516 cm^2.

The answers to b. to e. will vary and depend on your personal circumstances. Check your answers with another student from your class if possible.

3. $$\begin{aligned} A &= bh \\ &= 10'6'' \times 11' \\ &= 10.5' \times 11' \qquad 6'' = \frac{6}{12}' = 0.5' \\ &= 115.5 \text{ ft}^2 \end{aligned}$$

The area of the bedroom floor is 115.5 ft^2.

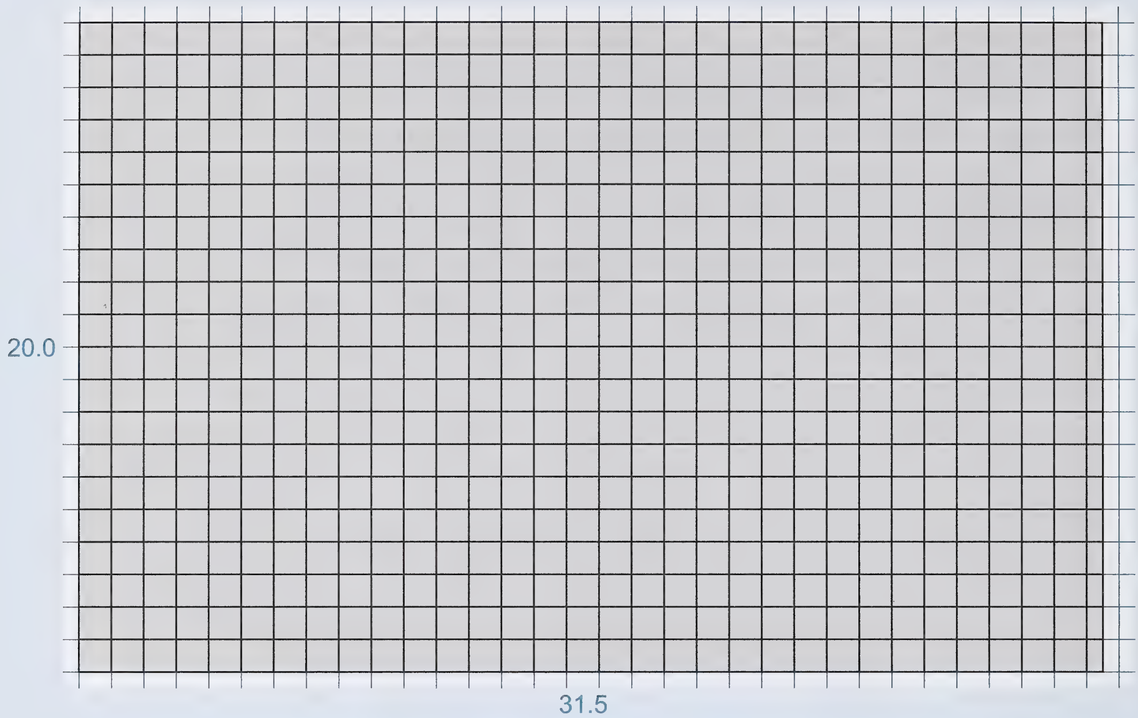
4. a. $$\begin{aligned} 9.6 \text{ m} &= 9.6 \times 3.281 \text{ ft} \\ &= 31.4976 \text{ ft} \\ &\doteq 31.5 \text{ ft} \end{aligned}$$

$$\begin{aligned} 6.1 \text{ m} &= 6.1 \times 3.281 \text{ ft} \\ &= 20.0141 \text{ ft} \\ &\doteq 20.0 \text{ ft} \end{aligned}$$

b. $$\begin{aligned} A &= bh \\ &= 31.5 \text{ ft} \times 20.0 \text{ ft} \\ &= 630 \text{ ft}^2 \end{aligned}$$

c. A total of 630 tiles will be needed to cover the floor.

d.



1 square $= 1 \text{ ft}^2$ or 1 tile

There are 20×31 full tiles.

$20 \times 31 = 620$ tiles

There are $620 + 10 = 630$ tiles altogether.

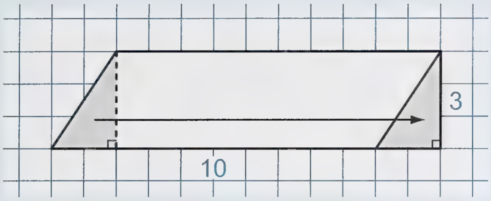
There are 20 half tiles.

$20 \times 0.5 = 10$ tiles

5. a. A
   b. P
   c. N
   d. P
   e. A
   f. A
   g. P
   h. B

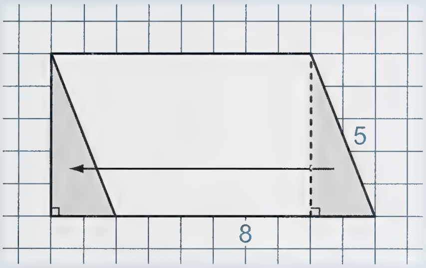
13. **Textbook, pages 180 to 182, "Put into Practice," questions 1 to 3**

1. **a.**



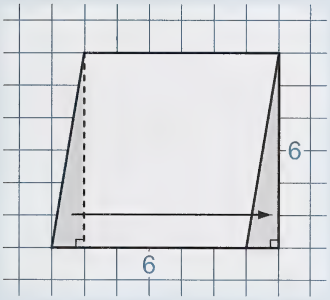
$A = bh$
$= 10 \times 3$
$= 30$

b.



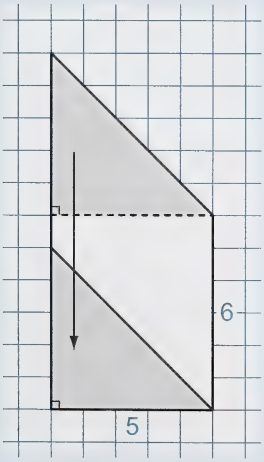
$A = bh$
$= 8 \times 5$
$= 40$

c.



$A = bh$
$= 6 \times 6$
$= 36$

d.



$A = bh$
$= 5 \times 6$
$= 30$

The area of a parallelogram is the product of its base and its vertical height.

2.

Rectangle			Parallelogram		
Base (ft)	Height (ft)	Area (ft^2)	Area (ft^2)	Base (ft)	Height (ft)
9	4	36	36	9	4
5	2	10	10	5	2
$2\frac{1}{2}$	6	15	15	$2\frac{1}{2}$	6
10	5	50	50	10	5
3	$6\frac{1}{2}$	19.5	19.5	3	$6\frac{1}{2}$

3. a. $A = bh$
$= 5 \text{ ft} \times 8 \text{ ft}$
$= 40 \text{ ft}^2$

b. $A = bh$
$= 8 \text{ ft} \times 5 \text{ ft}$
$= 40 \text{ ft}^2$

c. $A = bh$
$= 8 \text{ ft} \times 5 \text{ ft}$
$= 40 \text{ ft}^2$

d. $A = bh$
$= 8 \text{ ft} \times 5 \text{ ft}$
$= 40 \text{ ft}^2$

e. $A = bh$
$= 8 \text{ ft} \times 2\frac{1}{2} \text{ ft}$
$= \overset{4}{\cancel{8}} \text{ ft} \times \frac{5}{\underset{1}{\cancel{2}}} \text{ ft}$
$= 20 \text{ ft}^2$

f. $A = bh$
$= 3\frac{1}{2} \text{ ft} \times 6 \text{ ft}$
$= \frac{7}{\underset{1}{\cancel{2}}} \text{ ft} \times \overset{3}{\cancel{6}} \text{ ft}$
$= 21 \text{ ft}^2$

14. Textbook, page 182, "Investigation"

When Keaton put the two triangles together, he saw a parallelogram.

The area of the original triangle is one-half the area of the parallelogram.

Keaton used the formula $A = b \times h$ to find the area of the parallelogram.

$$A = \frac{1}{2} \times b \times h$$

$$= \frac{1}{\underset{1}{\cancel{2}}} \times 9 \times \overset{2}{\cancel{4}}$$

$$= 18$$

When you count squares, you also get 18.

15. Textbook, page 183, "Put into Practice," questions 4 to 6

4. a. $A = 0.5 \times b \times h$
$= 0.5 \times 6 \times 4$
$= 12$

b. $A = 0.5 \times b \times h$
$= 0.5 \times 10 \times 5$
$= 25$

c. $A = 0.5 \times b \times h$
$= 0.5 \times 12 \times 2$
$= 12$

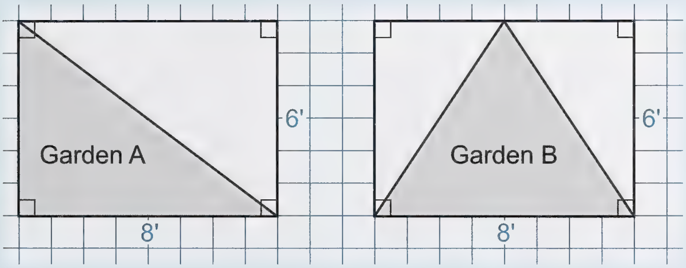
d. $A = 0.5 \times b \times h$
$= 0.5 \times 3 \times 8$
$= 12$

5. a. $A = 0.5 \times b \times h$
$= 0.5 \times 5 \times 8$
$= 20$

b. $A = 0.5 \times b \times h$
$= 0.5 \times 8 \times 5$
$= 20$

c. $A = 0.5 \times b \times h$
$= 0.5 \times 8 \times 5$
$= 20$

6.



area of Garden A $= \frac{1}{2} \times b \times h$

$= \frac{1}{\cancel{2}_1} \times \cancel{8}^4 \text{ ft} \times 6 \text{ ft}$

$= 24 \text{ ft}^2$

area of Garden B $= \frac{1}{2} \times b \times h$

$= \frac{1}{\cancel{2}_1} \times \cancel{8}^4 \text{ ft} \times 6 \text{ ft}$

$= 24 \text{ ft}^2$

The areas of the two gardens are the same because they have the same base and height.

16. Textbook, pages 184 to 192, "Put into Practice," questions 7, 8, 9, 11, 12, 13, 15, 17, 18, and 20

7. Find the area of each garden.

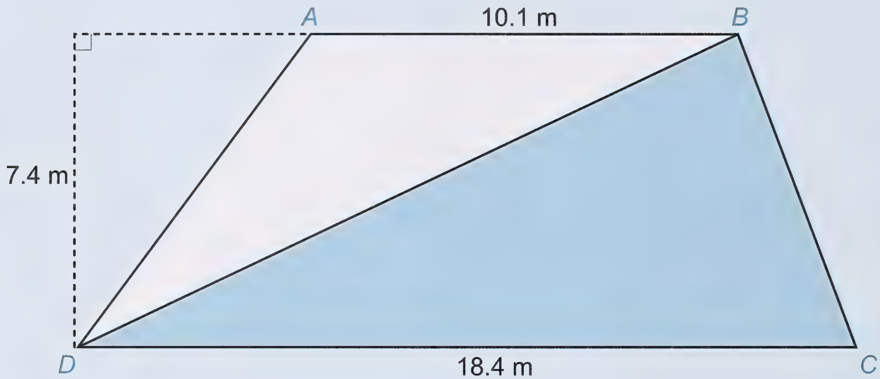
a. $A = bh$
$= 10.2\text{ m} \times 10.2\text{ m}$
$= 104.04\text{ m}^2$

b. $A = bh$
$= 15.3\text{ m} \times 6.9\text{ m}$
$= 105.57\text{ m}^2$

c. $A = bh$
$= 12.4\text{ m} \times 6.7\text{ m}$
$= 83.08\text{ m}^2$

d. $A = 0.5 \times b \times h$
$= 0.5 \times 16.8\text{ m} \times 12.5\text{ m}$
$= 105\text{ m}^2$

e.

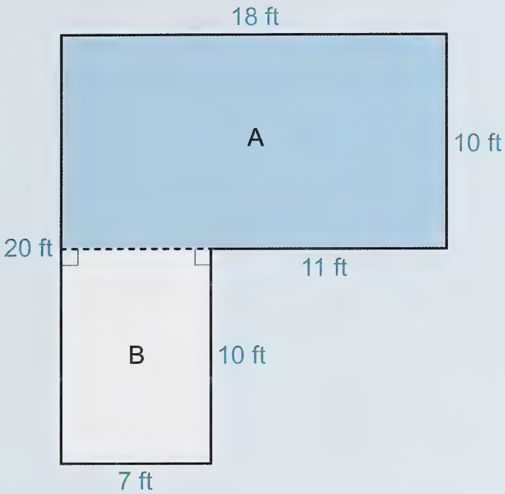


Divide the trapezoid into two triangles.

$$\begin{aligned}\text{area of trapezoid } ABCD &= \Delta BCD + \Delta ABD \\ &= (0.5 \times 18.4\text{ m} \times 7.4\text{ m}) + (0.5 \times 10.1\text{ m} \times 7.4\text{ m}) \\ &= 68.08\text{ m}^2 + 37.37\text{ m}^2 \\ &= 105.45\text{ m}^2\end{aligned}$$

The largest garden is rectangle B.

8. a.



Divide the floor into two rectangles, A and B.

$$\begin{aligned}\text{area of floor} &= \text{Rectangle A} + \text{Rectangle B}\\ &= (18\text{ ft} \times 10\text{ ft}) + (7\text{ ft} \times 10\text{ ft})\\ &= 180\text{ ft}^2 + 70\text{ ft}^2\\ &= 250\text{ ft}^2\end{aligned}$$

b. $$\begin{aligned}\text{square feet for waste} &= 0.1 \times \text{area of floor}\\ &= 0.1 \times 250\text{ ft}^2\\ &= 25\text{ ft}^2\end{aligned}$$

The total number of square feet of flooring the installer needs is $250\text{ ft}^2 + 25\text{ ft}^2 = 275\text{ ft}^2$.

c. $275\text{ ft}^2 \div 15\text{ ft}^2 \doteq 18.33$

Because the installer cannot buy partial packages, she must buy 19 packages.

d. $$\begin{aligned}\text{cost of flooring} &= 19 \times \$45\\ &= \$855\end{aligned}$$

e. She does not need the 25 ft^2 of flooring left over.

f. $25 \text{ ft}^2 \div 15 \text{ ft}^2 \doteq 1.66$

She can return only complete boxes. Therefore, she can return 1 box.

g. i. $\text{installation charge} = 3 \times 8 \text{ h} \times \$12.50/\text{h}$
$= \$300$

ii. $\text{installation charge} = 250 \text{ ft}^2 \times \$1.30/\text{ft}^2$
$= \$325$

9. a.
$$\begin{aligned}\text{area of dining room} &= \text{area of 2 walls } 8 \text{ ft} \times 12 \text{ ft} + \text{ area of 2 walls } 8 \text{ ft} \times 14 \text{ ft} \\ &\quad - \text{area of door} - \text{area of rectangle opening} - \text{area of window} \\ &= (2 \times 8 \text{ ft} \times 12 \text{ ft}) + (2 \times 8 \text{ ft} \times 14 \text{ ft}) - (2.5 \text{ ft} \times 6 \text{ ft}) - (6 \text{ ft} \times 6.5 \text{ ft}) \\ &\quad - (4 \text{ ft} \times 2 \text{ ft}) \\ &= 192 \text{ ft}^2 + 224 \text{ ft}^2 - 15 \text{ ft}^2 - 39 \text{ ft}^2 - 8 \text{ ft}^2 \\ &= 354 \text{ ft}^2\end{aligned}$$

b. $354 \text{ ft}^2 \div 65 \text{ ft}^2 \doteq 5.45$

Paint is sold only in 4-L or 1-L cans. Therefore, 6 L of paint are needed.

c. Buy one 4-L can and two 1-L cans.

$$\begin{aligned}\text{cost of paint} &= (1 \times \$39.95) + (2 \times \$13.95) \\ &= \$39.95 + \$27.90 \\ &= \$67.85\end{aligned}$$

The total cost for the paint is $67.85.

Buy six 1-L cans.

$$\begin{aligned}\text{cost of paint} &= 6 \times \$13.95 \\ &= \$83.70\end{aligned}$$

Buy two 4-L cans.

$$\begin{aligned}\text{cost of paint} &= 2 \times \$39.95 \\ &= \$79.90\end{aligned}$$

The least expensive way is to buy one 4-L can and two 1-L cans.

d. cost of doing it themselves $= 4\text{ h} \times \$35/\text{h}$
$= \$140$

cost of hiring a professional painter $= 3\text{ h} \times \$40/\text{h}$
$= \$120$

Yes, they should hire the professional painter.

e. They would save $\$140 - \$120 = \$20$ if they use the less expensive way.

f. cost for paint and labour $= \$67.85 + \$120$
$= \$187.85$

11. a.

$$\begin{aligned} A &= b \times h \\ 144\ \text{m}^2 &= 16\ \text{m} \times h \\ h &= 144\ \text{m}^2 \div 16\ \text{m} \\ &= 9\ \text{m} \end{aligned}$$

The field can be 9 m wide.

b.

$$\begin{aligned} P &= 2(b+h) \\ &= 2(16\ \text{m} + 9\ \text{m}) \\ &= 2(25\ \text{m}) \\ &= 50\ \text{m} \end{aligned}$$

The perimeter of the field is 50 m.

c. Divide the perimeter by the length of a panel.

$50\text{ m} \div 3\text{ m} = 16.66$

Seventeen panels are required.

$$\begin{aligned} \text{cost} &= 17 \times \$15.49 \\ &= \$263.33 \end{aligned}$$

It will cost $263.33 for enough panels to enclose the field.

12. a.

$$\begin{aligned} P &= 8 \times 30\text{ cm} \\ &= 240\text{ cm} \\ &= 240 \times 0.01\text{ m} \\ &= 2.4\text{ m} \end{aligned}$$

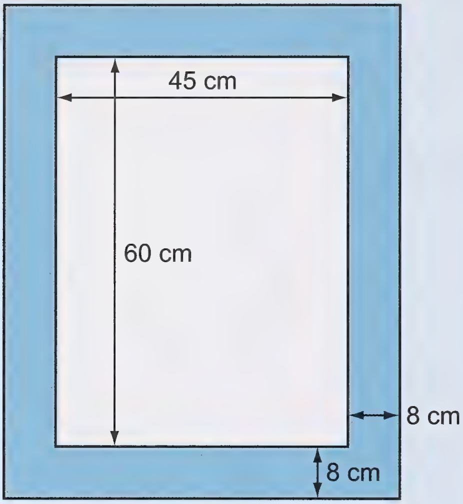
The approximate length of the white stripe around the outside is 2.4 m.

b. area $= 8 \times$ area of yellow triangle

$$\begin{aligned} &= 8 \times 0.5 \times b \times h \\ &= 8 \times 0.5 \times 30 \text{ cm} \times (72.43 \text{ cm} \div 2) \\ &= 8 \times 0.5 \times 30 \text{ cm} \times 36.215 \text{ cm} \\ &= 4345.8 \text{ cm}^2 \\ &\doteq 4346 \text{ cm}^2 \end{aligned}$$

The area of the stop sign is 4346 cm^2.

13.



overall width $= 45 \text{ cm} + 8 \text{ cm} + 8 \text{ cm}$
$= 61 \text{ cm}$

overall height $= 60 \text{ cm} + 8 \text{ cm} + 8 \text{ cm}$
$= 76 \text{ cm}$

a. area of painting $= b \times h$

$$\begin{aligned} &= 45 \text{ cm} \times 60 \text{ cm} \\ &= 2700 \text{ cm}^2 \end{aligned}$$

b. total area $= b \times h$

$$\begin{aligned} &= 61 \text{ cm} \times 76 \text{ cm} \\ &= 4636 \text{ cm}^2 \end{aligned}$$

c. area of frame $=$ total area $-$ area of painting

$$\begin{aligned} &= 4636 \text{ cm}^2 - 2700 \text{ cm}^2 \\ &= 1936 \text{ cm}^2 \end{aligned}$$

d. outside perimeter $= 2(61 \text{ cm} + 76 \text{ cm})$

$$\begin{aligned} &= 2(137 \text{ cm}) \\ &= 274 \text{ cm} \end{aligned}$$

15. a. Divide the area of the roof by the area one bundle of shingles covers.

$$268 \text{ m}^2 \div 10 \text{ m}^2 = 26.8$$

Therefore, Jody needs 27 bundles of shingles.

b. $$\begin{aligned} \text{cost} &= 27 \times \$185.50 \\ &= \$5008.50 \end{aligned}$$

c. $$\begin{aligned} \text{total length of eavestrough} &= (2 \times 25.75 \text{ m}) + (2 \times 12.85 \text{ m}) \\ &= 77.2 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{cost} &= 77.2 \text{ m} \times \$12.50/\text{m} \\ &= \$965.00 \end{aligned}$$

It will cost $965.00 to replace the eavestrough.

17. a. $$\begin{aligned} \text{area of yard} &= 40 \text{ m} \times 30 \text{ m} \\ &= 1200 \text{ m}^2 \end{aligned}$$

Divide the area of the yard by the area a bag of fertilizer can cover.

$$1200 \text{ m}^2 \div 480 \text{ m}^2 = 2.5$$

Veronica will need to buy 3 bags of fertilizer.

b. $$\begin{aligned} \text{total cost of fertilizer} &= 3 \times \$24.75 \\ &= \$74.25 \end{aligned}$$

$$\begin{aligned} \text{cost per square metre} &= \$74.25/1200 \text{ m}^2 \\ &= \$0.061\,875/\text{m}^2 \\ &\doteq \$0.06/\text{m}^2 \end{aligned}$$

18. area of one page $= 16 \text{ cm} \times 30 \text{ cm}$

$$= 480 \text{ cm}^2$$

266 pages of print uses 133 pieces of paper printed on both sides.

$$\begin{aligned} \text{total area of 133 pieces} &= 133 \times 480 \text{ cm}^2 \\ &= 63\,840 \text{ cm}^2 \\ &= 63\,840 \times 0.0001 \text{ m}^2 \\ &= 6.3840 \text{ m}^2 \end{aligned}$$

The area the pages can cover is approximately 6.4 m^2.

20. a. area of rectangle $= 60 \text{ m} \times 100 \text{ m}$

$$= 6000 \text{ m}^2$$

$$\begin{aligned} \text{perimeter of rectangle} &= 2(60 \text{ m} + 100 \text{ m}) \\ &= 2(160 \text{ m}) \\ &= 320 \text{ m} \end{aligned}$$

perimeter of square $= 320 \text{ m}$

$$\begin{aligned} \text{length of each side of the square} &= 320 \text{ m} \div 4 \\ &= 80 \text{ m} \end{aligned}$$

$$\begin{aligned} \text{area of square} &= 80 \text{ m} \times 80 \text{ m} \\ &= 6400 \text{ m}^2 \end{aligned}$$

The square has the larger area.

b. the difference in their area $= 6400 \text{ m}^2 - 6000 \text{ m}^2$

$$= 400 \text{ m}^2$$

Lesson 5: Volume and Capacity

1. Answers will vary. A sample answer is given.

The dimensions of a 1-L milk container are approximately 7 cm by 7 cm by 20.5 cm. The heights of 1-L and 2-L containers are the same and a 2-L container fits the dairy door of a refrigerator.

2. $$\begin{aligned} 1\text{ m}^3 &= 1\text{ m} \times 1\text{ m} \times 1\text{ m} \\ &= 10\text{ dm} \times 10\text{ dm} \times 10\text{ dm} \\ &= 1000\text{ dm}^3 \\ &= 1000\text{ L} \end{aligned}$$

3. **a.** $$\begin{aligned} 125\text{ mL} &= 125 \times 0.001\text{ L} \\ &= 0.125\text{ L} \end{aligned}$$
$$125\text{ mL} = 125\text{ cm}^3$$

b. $$600\text{ cm}^3 = 600\text{ mL}$$
$$\begin{aligned} 600\text{ mL} &= 600 \times 0.001\text{ L} \\ &= 0.6\text{ L} \end{aligned}$$

c. $$\begin{aligned} 60\text{ L} &= 60 \times 1000\text{ mL} \\ &= 60\ 000\text{ mL} \end{aligned}$$
$$\begin{aligned} 60\text{ L} &= 60 \times 0.001\text{ m}^3 \\ &= 0.06\text{ m}^3 \end{aligned}$$

d. $$\begin{aligned} 250\text{ dm}^3 &= 250\text{ L} \\ &= 250 \times 0.001\text{ kL} \\ &= 0.250\text{ kL} \end{aligned}$$

e. $$\begin{aligned} 6000\text{ kL} &= 6000 \times 1000\text{ L} \\ &= 6\ 000\ 000\text{ L} \end{aligned}$$
$$\begin{aligned} 1\text{ m}^3 &= 1000\text{ L} \\ &= 1\text{ kL} \end{aligned}$$
$$6000\text{ kL} = 6000\text{ m}^3$$

f. $$\begin{aligned} 6\text{ m}^3 &= 6 \times 1000\text{ L} \\ &= 6000\text{ L} \end{aligned}$$
$$6\text{ m}^3 = 6000\text{ dm}^3 \qquad 1\text{ L} = 1\text{ dm}^3$$

4. There are 27 ft^3 in 1 yd^3.

$$\begin{aligned} 1\text{ yd}^3 &= 1\text{ yd} \times 1\text{ yd} \times 1\text{ yd} \\ &= 3\text{ ft} \times 3\text{ ft} \times 3\text{ ft} \\ &= 27\text{ ft}^3 \end{aligned}$$

5. **a.** $$\begin{aligned} 2\text{ qt} &= 2\text{ qt} \div 4\text{ qt/gal} \\ &= 0.5\text{ gal} \\ &= 0.5 \times 4.546\text{ L} \\ &= 2.273\text{ L} \end{aligned}$$

b. $$\begin{aligned} 15\text{ yd}^3 &= 15 \times 0.765\text{ m}^3 \\ &= 11.475\text{ m}^3 \end{aligned}$$

c. $$\begin{aligned} 20\text{ gal} &= 20 \times 4.546\text{ L} \\ &= 90.92\text{ L} \end{aligned}$$

d. $$\begin{aligned} 10\text{ in}^3 &= 10 \times 16.387\text{ cm}^3 \\ &= 163.87\text{ cm}^3 \end{aligned}$$

6. **Textbook, page 194, "Investigation," questions 1 and 2**

1. **a.** Six cubes fill the bottom of the box.

   b. $6 \times 2 = 12$ cubes were needed to make 2 layers.

   c. $6 \times 3 = 18$ cubes were needed to make 3 layers.

   d. $6 \times 6 = 36$ cubes were needed to make 6 layers.

   e. It would take 48 cubes to fill the box.

   Because the box is 8 cm high, 8 layers are needed to fill the box.

   $8 \times 6 = 48$ cubes would be needed to make 8 layers.

   f. The volume of the box is 48 cm^3.

2. **a.** Eighteen cubes fill the bottom of the box.
   b. Zara will need 5 layers to fill the box.
   c. $5 \times 18 = 90$ cubes are needed to fill the box.
   d. The volume of the box is 90 in^3.

7. **Textbook, pages 195 to 197, "Put into Practice," questions 1, 4, 5, 6, and 7**

1. First you would find the dimensions (length, width, and height) of the box. Then, to find the volume, you would use the formula $V = \ell \times w \times h$.

4. **a.** The depth of the potting soil will be $8'' - 1'' = 7''$.

   b.
$$\begin{aligned}\text{volume} &= \ell \times w \times h \\ &= 34 \text{ in} \times 7 \text{ in} \times 7 \text{ in} \\ &= 1666 \text{ in}^3\end{aligned}$$

   The volume of soil needed for one flower box is 1666 in^3.

   c. George needs $3 \times 1666 \text{ in}^3 = 4998 \text{ in}^3$ of soil for 3 boxes.

d. $4998 \text{ in}^3 = 4998 \times 16.387 \text{ cm}^3$

$= 81\,902.226 \text{ cm}^3$

$= 81\,902.226 \text{ mL}$

$= 81.902\,226 \text{ L}$

$\doteq 82 \text{ L}$

George needs about 82 L of soil.

e. $82 \text{ L} \div 25 \text{ L} = 3.28$

George should buy 4 bags of soil.

f. $\text{cost} = 4 \times \$1.98$

$= \$7.92$

The soil would cost \$7.92.

5. **a.** $V = \ell \times w \times h$

$= 180 \text{ cm} \times 120 \text{ cm} \times 10 \text{ cm}$

$= 216\,000 \text{ cm}^3$

The air mattress holds $216\,000 \text{ cm}^3$.

b. $216\,000 \text{ cm}^3 \div 18\,000 \text{ cm}^3/\text{min} = 12 \text{ min}$

It would take 12 minutes to fill the air mattress.

6. $V = \ell \times w \times h$

$= 2 \text{ m} \times 1.5 \text{ m} \times 0.25 \text{ m}$ $25 \text{ cm} = 0.25 \text{ m}$

$= 0.75 \text{ m}^3$

$0.75 \text{ m}^3 = 0.75 \times 1.308 \text{ yd}^3$

$= 0.981 \text{ yd}^3$

Because you cannot buy part of a cubic yard, you will need to order 1 yd^3.

7. **a.** volume
   b. area
   c. neither
   d. volume
   e. area

Lesson 6: Mass and Weight

1. **a.** $150\text{ lb} = 150 \times 0.454\text{ kg}$
   $= 68.1\text{ kg}$

   b. $50\text{ g} = 50 \times 0.035\text{ oz}$
   $= 1.75\text{ oz}$

   c. $16\text{ oz} = 16 \times 28.350\text{ g}$
   $= 453.6\text{ g}$
   $\doteq 454\text{ g}$

   d. $1\text{ tonne} = 1000\text{ kg}$
   $= 1000 \times 2.205\text{ lb}$
   $= 2205\text{ lb}$
   $= 2205\text{ lb} \div 2000\text{ lb/ton}$
   $= 1.1025\text{ tons}$

2. **Textbook, pages 198 to 200, "Put into Practice," questions 3 to 18**

   3. Answers will vary. Sample answers are given.

      a. a litre of milk, a partridge
      b. a robin, a feather
      c. a toddler, a 20-inch television
      d. a pound of butter, a pint of water
      e. a loonie, a pair of glasses
      f. a 6-month-old child, a computer monitor

   4. **a.** $14\text{ kg} = 14 \times 2.205\text{ lb}$
      $= 30.87\text{ lb}$
      $\doteq 31\text{ lb}$

      Parin's turkey is about 31 lb.

      b. $31\text{ lb} \times 20\text{ min/lb} = 620\text{ min}$
      $620\text{ min} = 600\text{ min} + 20\text{ min}$
      $= 10\text{ h } 20\text{ min}$
      $\doteq 10.333\text{ h}$

      Parin needs to cook the turkey about 10.5 h.

   5. **a.** Ms. Cross needs 25 kg of clay.

      b. $10\text{ lb} = 10 \times 0.454\text{ kg}$
      $= 4.54\text{ kg}$

      There are 4.54 kg of clay in one 10-lb box.

c. $25 \text{ kg} \div 4.54 \text{ kg/box} \doteq 5.5$ boxes

Ms. Cross needs to buy 6 boxes of clay.

6.

James weighs 118 lbs.	Kyle has a mass of 65 kg.
Kyle weighs $65 \times 2.205 \text{ kg} \doteq 143 \text{ lb}$.	James has a mass of $118 \times 0.454 \text{ kg} = 53.572 \text{ kg}$.
Kyle is $143 \text{ lb} - 118 \text{ lb}$ or 25 lb heavier than James.	Kyle is $65 \text{ kg} - 53.572 \text{ kg} = 11.428 \text{ kg}$ heavier than James.

7. a. $$\begin{aligned} \text{area} &= b \times h \\ &= 19 \text{ ft} \times 12 \text{ ft} \\ &= 228 \text{ ft}^2 \end{aligned}$$

b. $228 \text{ ft}^2 \div 90 \text{ ft}^2/\text{pail} = 2.53$ pails

Therefore, 3 pails of texture are needed to cover the ceiling.

c. $$\begin{aligned} \text{area} &= b \times h \\ &= 8 \text{ m} \times 10 \text{ m} \\ &= 80 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} 80 \text{ m}^2 &\doteq 80 \times 10.764 \text{ ft}^2 \\ &\doteq 860.32 \\ &\doteq 860 \text{ ft}^2 \end{aligned}$$

The area of this ceiling is about 860 ft^2.

d. $860 \text{ ft}^2 \div 90 \text{ ft}^2/\text{pail} \doteq 9.6$ pails

Therefore, 10 pails are needed to cover the ceiling in question c.

8. $$\begin{aligned} 3 \text{ lb} &= 3 \times 0.454 \text{ kg} \\ &= 1.362 \text{ kg} \end{aligned}$$

You need to purchase 1.362 kg of wings or about 1.4 kg.

9. a. $400 \text{ lb} = 400 \times 0.454 \text{ kg}$
$= 181.6 \text{ kg}$
$\doteq 182 \text{ kg}$

Azwar needs about 182 kg of cement.

b. $182 \text{ kg} \div 20 \text{ kg/bag} = 9.1 \text{ bags}$

Azwar should order 10 bags of cement.

10. $\$1.22/\text{lb} = \$1.22 \times 2.205/\text{kg}$
$\doteq \$2.69/\text{kg}$

The price of apples is $\$2.69/\text{kg}$.

11. a. $\$3.13/\text{lb} = \$3.13 \times 2.205/\text{kg}$
$\doteq \$6.90/\text{kg}$

b. $\$3.42/\text{lb} = \$3.42 \times 2.205/\text{kg}$
$\doteq \$7.54/\text{kg}$

c. $\$4.56/\text{lb} = \$4.56 \times 2.205/\text{kg}$
$\doteq \$10.05/\text{kg}$

d. $\$3.85/\text{lb} = \$3.85 \times 2.205/\text{kg}$
$\doteq \$8.49/\text{kg}$

Section 2: Central Tendencies

Lesson 1: Mean, Median, and Mode

1. Textbook, pages 336 to 338, "Put into Practice," questions 1, 2, 5, 6, and 7

1. a. $\text{mean} = \dfrac{25+20+8+20+7+5+20}{7}$
$= 15$

b. Order the data.

5, 7, 8, 20, 20, 20, 25

There are 7 values in the set.

Because $\frac{7}{2} = 3.5$, the middle value is the fourth value.

$\text{median} = 20$

c. $\text{mode} = 20$

d. range = highest value − lowest value

$$= 25 - 5$$
$$= 20$$

2. a. To calculate the mean of a set of numbers, divide the sum of the numbers by the number of numbers in the set.

   b. The median of a set of numbers is the middle number when the set of numbers is arranged in order and if there is an odd number of numbers in the set. If there is an even number of numbers, then add the two middle numbers and divide by two.

   c. The mode is the most frequent number found in the set.

   d. To calculate the range, subtract the smallest number from the largest number.

5. a. i. $\text{mean} = \dfrac{8+15+7+21+12}{5}$

$$= 12.6$$

   ii. Order the numbers.

   7, 8, 12, 15, 21

   Because there are 5 numbers in the set and $\frac{5}{2} = 2.5$, the middle number is the third number.

   median = 12

   iii. Each number only occurs once. There is no mode.

   iv. range = 21 − 7

$$= 14$$

   b. i. $\text{mean} = \dfrac{2+6+1+4+3+6+8}{7}$

$$= \frac{30}{7}$$
$$= 4\tfrac{2}{7}$$
$$\doteq 4.29$$

ii. Order the numbers.

1, 2, 3, 4, 6, 6, 8

Because there are 7 numbers in the set and $\frac{7}{2} = 3.5$, the middle number is the fourth number.

median $= 4$

iii. mode $= 6$

iv. range $= 8 - 1$

$= 7$

c. i. mean $= \dfrac{7+3+5+7+2+8+4+9}{8}$

$= \dfrac{45}{8}$

$= 5.625$

ii. Order the numbers.

2, 3, 4, 5, 7, 7, 8, 9

There are 8 numbers in the set.

Because $\frac{8}{2} = 4$, count 4 numbers from each end.

Average the numbers.

median $= \dfrac{5+7}{2}$

$= 6$

iii. mode $= 7$

iv. range $= 9 - 2$

$= 7$

6. **a.** and **b.** If the mean of the starting five is $2000, then the sum of the five salaries is $5 \times \$2000 = \$10\ 000$.

$$\$10\ 000 = \$2000 + \$2000 + \$3000 + \$1000 + \text{Shannon's salary}$$
$$\$10\ 000 = \$8000 + \text{Shannon's salary}$$

Therefore, $\text{Shannon's salary} = \$10\ 000 - \$8000$
$= \$2000$

7. **a. i.** $\text{mean} = \dfrac{25+20+18+20+17+13+20}{7}$

$= 19$

ii. Order the numbers.

13, 17, 18, 20, 20, 20, 25

There are 7 numbers in the set.

Because $\frac{7}{2} = 3.5$, the median is the fourth number.

$\text{median} = 20$

iii. $\text{mode} = 20$

iv. $\text{range} = 25 - 13$
$= 12$

b. i. $\text{mean} = \dfrac{25+20+18+20+17+13+20+13+25}{9}$

$= 19$

The mean did not change.

ii. Order the numbers.

13, 13, 17, 18, 20, 20, 20, 25, 25

The median is the 5th number.

median = 20

The median did not change.

iii. mode = 20

The mode did not change.

iv. range = 25 − 13

$= 12$

The range did not change.

2. Textbook, page 339, "Investigation," questions a. to c.

a. Tomson

i. $\text{mean} = \dfrac{20+19+20+22+19+20+18}{7}$

$\doteq 19.7$

ii. Order the points Tomson scored.

18, 19, 19, 20, 20, 20, 22

median = 20

iii. mode = 20

iv. range = 22 − 18

$= 4$

Cameron

i. $\text{mean} = \dfrac{26+10+15+25+17+15+16}{7}$

$\doteq 17.7$

ii. Order the points Cameron scored.

10, 15, 15, 16, 17, 25, 26

median $= 16$

iii. mode $= 15$

iv. range $= 26 - 10$

$= 16$

Buffey

i. $\text{mean} = \dfrac{21+10+21+12+14+11+15}{7}$

$= 14.9$

ii. Order the points Buffey scored.

10, 11, 12, 14, 15, 21, 21

median $= 14$

iii. mode $= 21$

iv. range $= 21 - 10$

$= 11$

b. Answers will vary. A sample answer is given.

Tomson is the most valuable player.

c. Tomson has the highest median and mean scores and the lowest range. Having the lowest range means he is more consistent than the other two players.

3. **Textbook, pages 339 and 340, "Put into Practice," questions 2 to 4**

2. $\text{mean} = \dfrac{8.2+3.4+0.3+2.7+9.1+5.6+8.2+6.2+4.2+10.1}{10}$

$= 5.8$

Next, find the median.

Order the numbers.

0.3, 2.7, 3.4, 4.2, 5.6, 6.2, 8.2, 8.2, 9.1, 10.1

There are 10 numbers.

Because $\frac{10}{2} = 5$, count 5 numbers from each end. These numbers are 5.6 and 6.2. Find their mean.

Therefore, $\text{median} = \dfrac{5.6+6.2}{2}$

$= 5.9$

$\text{mode} = 8.2$

$\text{range} = 10.1 - 0.3$

$= 9.8$

3. $\text{mean} = \dfrac{\$1256+\$2900+\$2595+\$2475+\$3680+\$3372}{6}$

$= \$2713$

The player's mean monthly income was $2713.

4. a. $\text{mean} = 159.6$

$\doteq 160$

The mean height was about 160 cm.

b. $\text{median} = \dfrac{160 + 160}{2}$
$= 160$

The median height was 160 cm.

c. The mode height was 160 cm.

d. The one number that best describes the heights is 160 cm.

Lesson 2: Choosing the Mean, Median, or Mode

1. **Textbook, page 341, "Investigation," questions a. and b.**

   a. You will give the ball to Shane because your team is on the 1-yd line, and Shane is more consistent than Max, even though Shane's mean is lower. Shane's mean, median, and mode are all 2 yd. Your team only has to make 1 yd to score a touchdown!

   b. Do others agree with you?

2. **Textbook, page 342, "Put into Practice," questions 1 and 3**

   1. a. If you were a player agent, you would use the highest measure of central tendency, the mean of $631 578.95. You would want to start at a high value.

      b. If you were an owner, you would use the lowest measure of central tendency, the mode of $200 000. You would want to start at a low value.

   3. a. The final mark should be based on the mean of test and quiz marks. Higher marks tend to cancel out lower marks when the mean is calculated.

      b. The median is the best choice to quote house prices. A few very expensive houses would inflate the mean and give you the wrong impression of what houses are selling for.

      c. The mode is the best measure for shoe sizes. The mode will indicate the most frequent size of shoe your sports store sells.

      d. The mean is the best measure of fuel consumption. The van will be fairly consistent in the rate it burns fuel.

      e. The median is the best measure for discussing salaries people are paid. The median salary will eliminate bias introduced by extremely high or low salaries.

3. Textbook, pages 343 to 345, "Put into Practice," questions 1, 2, 6, 7, and 10

1. a. $\text{mean} = \dfrac{50+47+33+30+18+31+26+13+17+19}{10}$

$= 28.4$

b. Order the numbers of goals.

13, 17, 18, 19, 26, 30, 31, 33, 47, 50

Because there are 10 numbers in the set, count $\frac{10}{2}$ or 5 numbers from either end.

$\text{median} = \dfrac{26+30}{2}$

$= 28$

c. The average player on the wheelchair hockey team scores about 28 points.

2. a. $\text{mean} = \dfrac{\$112\,500+\$69\,819+\$45\,288+\$45\,288+\$29\,248}{5}$

$\doteq \$60\,429$

b. $\text{median} = \$45\,288$

c. The mean is higher because it is affected by the extreme value of \$112 500, the amount won by the top player.

6. a. Order the numbers.

5.3, 5.3, 5.4, 5.5, 5.5, 5.5, 5.6

The median is 5.5.

b. $\text{mean} = \dfrac{5.3+5.3+5.4+5.5+5.5+5.5+5.6}{7}$

$\doteq 5.44$

c. Delete the highest and lowest scores.

$\cancel{5.3}$, 5.3, 5.4, 5.5, 5.5, 5.5, $\cancel{5.6}$

$$\begin{aligned}\text{mean} &= \frac{5.3+5.4+5.5+5.5+5.5}{5} \\ &= 5.44\end{aligned}$$

median $= 5.5$

mode $= 5.5$

7. a. Reasons why the highest and lowest scores are dropped include the following:

- Favouritism will not become too large a factor in determining winners.
- Bias against a particular skater will not adversely affect the overall score.

b. Diving is another sport where this procedure is used.

10. Answers will vary. A sample answer follows. The mode is the best statistic to use in choosing uniform sizes. The mode indicates the one size that fits the most players.

4. Textbook, pages 346 and 347, "Put into Practice," questions 1 and 2

1. a. The median is the fifth time for each group.

The median for the first group was $3:32:34$.

The median for the second group was $3:08:58$.

b. The contestants in the second group, the 1500-m wheelchair race, had the fastest times.

2. a. Range for 100-m amputee: $14.94\text{ s} - 12.72\text{ s} = 2.22\text{ s}$

Range for 100 m: $11.15\text{ s} - 10.82\text{ s} = 0.33\text{ s}$

b. The range was larger for the amputee racers. Thus, the other group was closer together at the end of the race.

c. The difference between the winning times was $12.72\text{ s} - 10.82\text{ s} = 1.90\text{ s}$.

d. The median times are 14.35 s and 11.02 s. Their difference is $14.35\text{ s} - 11.02\text{ s} = 3.33\text{ s}$.

Lesson 3: The Plus/Minus Statistic

1. Textbook, page 349, "Put into Practice," question 1

a.

Player	Games Played	Goals For	Goals Against	$+/-$ Number
Porter	31	8	34	-26
Micaela	31	15	21	-6
Darren	31	35	8	$+27$
Dan	30	35	12	$+23$
Brad	27	29	6	$+23$
Janet	31	35	14	$+21$
Tina	30	11	29	-18
Keith	3	1	3	-2

b. The statement that Keith's plus/minus number is much better than Micaela's is not reasonable. Micaela played over 10 times as many games as Keith, but Micaela's plus/minus number is only 3 times that of Keith's. As a matter of fact, Micaela's plus/minus number per game is better than Keith's.

c. Do others agree with your position?

d. $$\text{mean} = \frac{-26+(-6)+(+27)+(+23)+(+23)+(+21)+(-18)+(-2)}{8}$$
$$= +\frac{42}{8}$$
$$= +5.25$$

Order the $+/-$ numbers.

$-26,\ -18,\ -6,\ -2,\ +21,\ 23,\ 23,\ 27$

$$\text{median} = \frac{(-2)+(+21)}{2}$$
$$= \frac{19}{2}$$
$$= +9.5$$

mode $= +23$

e. If these are the only players on the team, the team is probably having a winning season. Both the mean and median are positive. The team has had more goals for than against. Of course, they could have won a few games by lopsided scores and, as a result, still have a losing season.

2. Textbook, page 350, "Put into Practice," question 2

2. a.

Player	Games Played	Points For	Points Against	+/− Number	+/− per Game
Marlene	5	292	217	+75	+15
Sandy	4	200	151	+49	+12.25
Mike	5	339	291	+48	+9.6
Shannon	5	376	329	+47	+9.4
Lain	5	349	320	+29	+5.8
Wade	2	87	72	+15	+7.5
Randa	4	117	103	+14	+3.5
Rob	5	295	291	+4	+0.8
Jennifer	1	11	11	0	0
Jay	5	241	252	−11	−2.2
Allan	2	87	108	−21	−10.5
Chris	2	65	87	−22	−11
Bryan	2	71	102	−31	−15.5

b. The top three players are Marlene, Sandy, and Mike.

c. and **d.** Answers will vary. The answers depend on your personal circumstances.

Review

1. Textbook, pages 203 to 207, "Review," questions 9 to 21

9. a. $\frac{7}{8}'' + \frac{5}{16}'' = \frac{7\times 2}{8\times 2}'' + \frac{5}{16}''$

$= \frac{14}{16}'' + \frac{5}{16}''$

$= \frac{19}{16}''$

$= 1\frac{3}{16}''$

b. $8\times\frac{3}{4}'' = \frac{\overset{2}{\cancel{8}}}{1}\times\frac{3}{\underset{1}{\cancel{4}}}''$

$= 6''$

c. $\frac{1}{2}\times 10\frac{3}{4}'' = \frac{1}{2}\times\frac{43}{4}''$

$= \frac{43}{8}''$

$= 5\frac{3}{8}''$

d. $\frac{1}{2}$ of $10\frac{3}{4}'' = \frac{1}{2}\times\frac{43}{4}''$

$= \frac{43}{8}''$

$= 5\frac{3}{8}''$

e. $10\frac{3}{4}'' \div 2'' = \frac{43}{4}\times\frac{1}{2}$

$= \frac{43}{8}$

$= 5\frac{3}{8}$

Therefore, you can get 5 pieces that are each $2''$ long.

f. $10\frac{3}{4}'' \div \frac{3}{4}'' = \frac{43}{\cancel{4}_1} \times \frac{\cancel{4}^1}{3}$

$= \frac{43}{3}$

$= 14\frac{1}{3}$

You can get 14 pieces that are each $\frac{3}{4}''$ long from a piece that is $10\frac{3}{4}''$ long.

g. $10\frac{3}{4}'' \div 2\frac{3}{4}'' = \frac{43}{4} \div \frac{11}{4}$

$= \frac{43}{\cancel{4}_1} \times \frac{\cancel{4}^1}{11}$

$= \frac{43}{11}$

$= 3\frac{10}{11}$

You can get 3 pieces that are each $2\frac{3}{4}''$ long from a piece that is $10\frac{3}{4}''$ long.

10. **a.** 1 cm = 0.394 in
b. 1 m = 1.094 yd
c. 1 m = 3.281 ft
d. $1\ m^3 = 1.308\ yd^3$
e. 1 g = 0.002 lb
f. 1 kg = 2.205 lb
g. 1 yd = 0.914 m
i. 1 in = 2.540 cm
j. 1 lb = 0.454 kg
k. 1 lb = 454 g
l. 1 ft = 12 in

11. $11\ m = 11 \times 3.281\ ft$

$= 36.091\ ft$

$\doteq 36\ ft$

There are about 36 ft of archaeological deposits.

12. Answers will vary. Sample answers are given.

a. A person who weighs 60 kg has bones of mass $60 \times 0.181\,\text{kg}$ or 10.86 kg.

b. A person who weighs 60 kg has a brain of mass 60×0.0299 kg or 1.794 kg.

c. A person who weighs 60 kg has $60 \times 0.579\text{ kg} = 34.74\text{ kg}$ of water in his or her body.

13. $$\begin{aligned} 800\text{ m} &= 800 \times 3.281\text{ ft} \\ &\doteq 2625\text{ ft} \end{aligned}$$

$$\begin{aligned} 1500\text{ m} &= 1500 \times 3.281\text{ ft} \\ &\doteq 4922\text{ ft} \end{aligned}$$

$$\begin{aligned} 15\text{ km} &= 15 \times 0.621\text{ mi} \\ &\doteq 9.3\text{ mi} \end{aligned}$$

$$\begin{aligned} 20\text{ km} &= 20 \times 0.621\text{ mi} \\ &\doteq 12.4\text{ mi} \end{aligned}$$

$$\begin{aligned} 300\text{ km/h} &= 300 \times 0.621\text{ mi/h} \\ &= 186.3\text{ mi/h} \end{aligned}$$

14. a. $$\begin{aligned} P &= 2(2\text{ cm} + 12\text{ cm}) \\ &= 2(14\text{ cm}) \\ &= 28\text{ cm} \end{aligned}$$

b. $$\begin{aligned} P &= 4 \times 3.8\text{ cm} \\ &= 15.2\text{ cm} \end{aligned}$$

c. $$\begin{aligned} P &= 2\left(3\tfrac{1}{2}\text{ ft} + 6\tfrac{1}{4}\text{ ft}\right) \\ &= 2(3.5\text{ ft} + 6.25\text{ ft}) \\ &= 2(9.75\text{ ft}) \\ &= 19.5\text{ ft} \\ &= 19\tfrac{1}{2}\text{ ft} \end{aligned}$$

d. $$\begin{aligned} P &= 3 \times 16\tfrac{3}{8}'' \\ &= \frac{3}{1} \times \frac{131}{8}'' \\ &= \frac{393}{8}'' \\ &= 49\tfrac{1}{8}'' \end{aligned}$$

e. $$\begin{aligned} P &= 64.3\text{ yd} + 36\text{ yd} + 66.8\text{ yd} + 32.1\text{ yd} \\ &= 199.2\text{ yd} \end{aligned}$$

f. $$\begin{aligned} P &= 24\text{ mi} + 14.8\text{ mi} + 4\text{ mi} + 12.8\text{ mi} + 24.2\text{ mi} \\ &= 79.8\text{ mi} \end{aligned}$$

15. **a.** $P = 2(5.5 \text{ m} + 7.3 \text{ m})$

$= 2(12.8 \text{ m})$

$= 25.6 \text{ m}$

The perimeter of the garden is 25.6 m.

b. $25.6 \text{ m} = 25.6 \times 3.281$

$= 83.9936 \text{ ft}$

$\doteq 84 \text{ ft}$

c. $84 \text{ ft} \div 6 \text{ ft} = 14$

Mrs. Magee will need 14 panels.

16. **a.** $A = 30 \text{ cm} \times 5 \text{ cm}$

$= 150 \text{ cm}^2$

b. $A = 1\frac{1}{2} \text{ ft} \times 1\frac{1}{2} \text{ ft}$

$= 1.5 \text{ ft} \times 1.5 \text{ ft}$

$= 2.25 \text{ ft}^2$

$= 2\frac{1}{4} \text{ ft}^2$

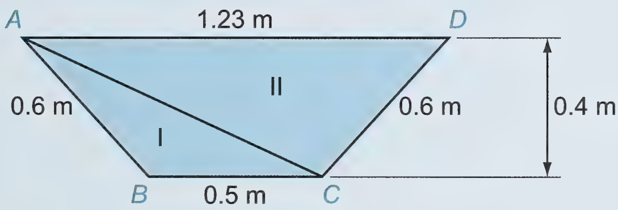
c. $A = 15.2 \text{ m} \times 9.1 \text{ m}$

$= 138.32 \text{ m}^2$

d. $A = 6.2 \text{ ft} \times 3.1 \text{ ft}$

$= 19.22 \text{ ft}^2$

17. **a.**



area = area of Δ I + area of Δ II

$= (0.5 \times 0.5 \text{ m} \times 0.4 \text{ m}) + (0.5 \times 1.23 \text{ m} \times 0.4 \text{ m})$

$= 0.1 \text{ m}^2 + 0.246 \text{ m}^2$

$= 0.346 \text{ m}^2$

b. $A = 0.5 \times 10 \text{ in} \times 12 \text{ in}$

$= 60 \text{ in}^2$

18. a. Put the 12-ft width along the wall that is 11.5 ft in length.

10 ft of this carpet is needed.

$$\begin{aligned} \text{area} &= 12 \text{ ft} \times 10 \text{ ft} \\ &= 120 \text{ ft}^2 \end{aligned}$$

Georgina will need 120 ft^2 of carpet to cover the floor.

b. $$\begin{aligned} \text{cost} &= 120 \text{ ft}^2 \times \$3.29/\text{ft}^2 \\ &= \$394.80 \end{aligned}$$

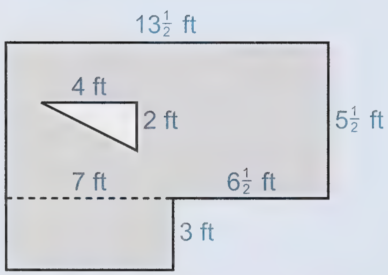
The carpet will cost $394.80.

19. a. $$\begin{aligned} \text{area of large rectangle} &= 16.5 \text{ m} \times 2.6 \text{ m} \\ &= 42.9 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{area of small rectangle} &= 4.5 \text{ m} \times 1.5 \text{ m} \\ &= 6.75 \text{ m}^2 \end{aligned}$$

$$\begin{aligned} \text{area of shaded rectangle} &= 42.9 \text{ m}^2 - 6.75 \text{ m}^2 \\ &= 36.15 \text{ m}^2 \end{aligned}$$

b.



$$\begin{aligned} \text{area of large rectangle} &= 13\tfrac{1}{2} \text{ ft} \times 5\tfrac{1}{2} \text{ ft} \\ &= 13.5 \text{ ft} \times 5.5 \text{ ft} \\ &= 74.25 \text{ ft}^2 \end{aligned}$$

$$\begin{aligned} \text{area of small rectangle} &= 7 \text{ ft} \times 3 \text{ ft} \\ &= 21 \text{ ft}^2 \end{aligned}$$

$$\text{area of both rectangles} = 74.25 \text{ ft}^2 + 21 \text{ ft}^2$$
$$= 95.25 \text{ ft}^2$$

$$\text{area of triangle} = 0.5 \times 4 \text{ ft} \times 2 \text{ ft}$$
$$= 4 \text{ ft}^2$$

$$\text{area of shaded region} = 95.25 \text{ ft}^2 - 4 \text{ ft}^2$$
$$= 91.25 \text{ ft}^2$$
$$= 91\tfrac{1}{4} \text{ ft}^2$$

20. **a.** $\text{area of wall} = 6 \text{ m} \times 3 \text{ m}$
$$= 18 \text{ m}^2$$

b. $18 \text{ m}^2 \div 3.9 \text{ m}^2 \doteq 4.6$

Mrs. Mackay needs 5 containers of wall texture.

21. $V = 2.5 \text{ m} \times 0.9 \text{ m} \times 0.3 \text{ m}$
$$= 0.675 \text{ m}^3$$

2. Textbook, pages 361 and 362, "Review," questions 2 to 7

2. **a.** $\text{mean} = \dfrac{10 + 9 + 13 + 14 + 9}{5}$
$$= 11$$

Order the data.

9, 9, 10, 13, 14

$\text{median} = 10$

$\text{mode} = 9$

$\text{range} = 14 - 9$
$$= 5$$

b. $\text{mean} = \dfrac{7+9+16+10+6+10+7+8+7+8+7+13}{12}$

$= 9$

Order the data.

6, 7, 7, 7, 7, 8, 8, 9, 10, 10, 13, 16

Count 6 numbers in from each end. Find the average of the two numbers reached.

$\text{average} = \dfrac{8+8}{2}$

$= 8$

Therefore, the $\text{median} = 8$.

$\text{mode} = 7$

$\text{range} = 16 - 6$

$= 10$

c. $\text{mean} = \dfrac{9+7+6+5+8+10+4+7}{8}$

$= \dfrac{56}{8}$

$= 7$

Order the data.

4, 5, 6, 7, 7, 8, 9, 10

$\text{median} = \dfrac{7+7}{2}$

$= 7$

$\text{mode} = 7$

$\text{range} = 10 - 4$

$= 6$

3. **a.** mean $= \dfrac{22\text{ yd} + 8\text{ yd} + 6\text{ yd} + 2\text{ yd} + 10\text{ yd} + 0\text{ yd} + (-3\text{ yd}) + (-1\text{ yd})}{8}$

$= \dfrac{44\text{ yd}}{8}$

$= 5.5\text{ yd}$

Order the data.

$-3, \ -1, \ 0, \ 2, \ 6, \ 8, \ 10, \ 22$

median $= \dfrac{2+6}{2}$

$= 4$

There is no mode because each value occurs once.

b. The median, 4, best describes his performance because he earned fewer yards 4 times and more yards 4 times. The mean, 5.5, which is higher than the median, may be a little optimistic. The mean was affected by his single long yardage gain of 22 yds.

4. mean $= \dfrac{75\text{ kg} + 81\text{ kg} + 58\text{ kg} + 64\text{ kg} + 86\text{ kg}}{5}$

$= 72.8\text{ kg}$

5. range $= 5 - 0$

$= 5$

6. **a.** The median height is 179 cm.

b. The median height was not affected.

183, 180, 179, 178, 176

median $= 179$ cm

7. mode $= 4$

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